Information Circular 9528

National Survey of the Mining Population
Part II: Mines

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Acronyms and Abbreviations

CI	Confidence Interval
DEFF	Design Effect
DSU	Data suppressed
FPC	Finite population corrected
FSR	Filter self-rescuer
FTE	Full-time Equivalent
IC	Information Circular
MIPS	Mining Industry Population Survey
MSHA	Mine Safety and Health Administration
NA	Not applicable
NIOSH	National Institute for Occupational Safety and Health
OMB	Office of Management and Budget
OMSHR	Office of Mine Safety and Health Research
PED	Personal emergency device
SCSR	Self-contained self-rescuer
SIC	Standard Industrial Classification
TTE	Through-the-Earth

Definition of Terms

Confidence Interval:	An interval that gives an estimated range of values which is likely to include an unknown population parameter, with the estimated range being calculated from a given set of sample data.
Jackknife Repeated Replication:	A commonly used resampling approach to variance estimation.
National Estimate:	A weighted statistical calculation which uses the results from a probability sample survey to estimate a national number.
Survey Count:	The actual number of responses obtained from the National Survey of the Mining Population.

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Abstract

The National Institute for Occupational Safety and Health (NIOSH) conducted the first comprehensive survey of the U.S. mining population in more than 20 years. The National Survey of the Mining Population captured the current profile of the U.S. mining workforce. Data collection began in March 2008 and continued through August 2008. Randomly selected mining operations in all of the major mining sectors (i.e., coal, metal, nonmetal, stone, and sand and gravel) received the survey and had the option of completing a paper or web-based questionnaire. A total of 737 mining operations returned completed questionnaires and reported data for 9,008 employees.

Two sets of data were collected in this national survey. There were questions about the mining operation, including employee training, work schedules, the use of independent contractor employees, and mine communication and safety systems. The employee questions included demographic and occupational questions about individual employees. The survey sample data were weighted in order to provide national estimates of mine and employee characteristics.

This Information Circular (IC) is published in two parts—"Part I: Employees" presents the employee-level data and "Part II: Mines" presents the mine-level data. Both parts of this IC include an overview of the survey background, development of the survey materials, sample design and sample selection, data collection and processing, statistical weighting, and lessons learned. The survey data are summarized for the overall U.S. mining industry and the five major mining sectors. The information gathered from the survey respondents is being published only as summarized data so that no single mining operation or employee can be identified.

Introduction

Surveillance of occupational injuries, illnesses, and exposures has been an integral part of the work of the National Institute for Occupational Safety and Health (NIOSH) since its creation by the Occupational Safety and Health Act in 1970. Surveillance activities at the Office of Mine Safety and Health Research (OMSHR) are focused on the nation's mining workforce. These surveillance activities make extensive use of data from a number of different national databases. The most frequently used databases are those maintained by the Mine Safety and Health Administration (MSHA). Included are databases of reported employment, accidents/injuries/illnesses, hazardous exposures, coal production, mine inspections, violations and citations, etc. Two of the most commonly used databases are the mine operator and contractor address/employment file and the file listing reports of accidents, injuries, and illnesses.

Analysis of data from the existing MSHA employment and accident/injury/illness databases has been able to meet some, but not all, of the OMSHR surveillance needs. For example, to identify subpopulations in each major mining sector or type of mining operation at risk of adverse health and safety outcomes, OMSHR needs the capability to calculate age-, gender-, and occupation-specific rates of injuries, fatalities, and disease. Additionally, due to the reduced reporting requirements for independent contractors, OMSHR cannot determine the number of contractor employees working separately in metal, nonmetal, stone, or sand and gravel operations. The National Survey of the Mining Population was designed to collect mine- and employee-level information to address these and other data gaps.

Background and Overview

The last national survey targeting the mining workforce, the Mining Industry Population Survey (MIPS), was conducted in 1986 by the U.S. Bureau of Mines (USBM) in the U.S. Department of the Interior. The mining industry has experienced many changes since the MIPS was conducted, and its data are too outdated to be considered useful for surveillance on the current mining workforce. In addition, the MIPS did not include any information on independent contractor employees. Therefore, the National Institute for Occupational Safety and Health, Office of Mine Safety and Health Research conducted this survey to provide updated demographic and occupational information on the mining workforce. The National Survey of the Mining Population collected information from each of the five major mining sectors (coal, metal, nonmetal, stone, and sand and gravel). The survey's main objectives were to:

- Collect basic information about mining operations.
- Establish the demographic and occupational characteristics of mine operator employees.
- Estimate the number of independent contractor employees used by mining operations.

Data collection began in March 2008 and continued through August 2008. A survey packet was mailed to each sampled mining operation. Respondents were given the option of completing a paper questionnaire or using a web questionnaire. Two sets of data were collected in this survey. The mine questions included items about the mining operations, communication and safety systems, and the mine's use of independent contractor employees. The employee questions included demographic and occupational questions about individual employees. The survey's employee-level data will be used by OMSHR to determine the accident rates for various demographic and occupational categories as well as provide information that will be used to improve the safety and health of miners.

This Information Circular (IC) is published in two parts—"Part I: Employees" presents the employee-level data and "Part II: Mines" presents the mine-level data. The employee and mine data are summarized for the overall U.S. mining industry and the major mining sectors. In addition, the data in the Mines IC is stratified by underground and surface for the coal, metal, nonmetal, and stone sectors. The information gathered from the survey respondents is being published only as summarized data so that no single mining operation or employee can be identified. The intent of this IC is to present the methodology used to design and conduct the survey and to provide up-to-date information about U.S. mining operations and their employees.

Survey Materials

A survey packet was developed which contained a cover letter, a questionnaire booklet with employee sampling instructions (Appendix A), directions for accessing the Internet version of the questionnaire, a Questions and Answers (Q&A) brochure (Appendix B), and a stamped, self-addressed return envelope.

The Paper Questionnaire

Each survey paper questionnaire booklet was personalized with a box at the top of page 1 which included: the mine ID number, the mine name, the reporting week (date), and a "submit-by" date. The Questionnaire Overview section presented general instructions and guidelines for completing the survey. The survey consisted of five parts as summarized below:

- <u>Mine Questions</u>—This first part of the questionnaire included sections on: Training; Other Languages; Work Schedules for Production Workers, Production Support Workers, and Preparation Plant/Mill Workers; Shift Work for these same three types of workers; Independent Contractor Employees; and Safety, Communication, and Rescue Measures.
- <u>Employee Selection Instructions</u>—This page contained step-by-step instructions for selecting the sample of employees to be included in the Employee Questions. Personalized mine information was preprinted at the top of this page, including: the mine ID number, the mine name, the reporting week (date), the range of the estimated number of employees working at the mine, a "start-with" number and a "take-every" number for selecting employees from the mine's employee roster.
- <u>Instructions for Employee Questions</u>—This two-page section of the questionnaire provided item-by-item explanations for the Employee Questions.

- Employee Questions—These items were formatted as a fold-out answer form. The sections included: Regular Job Title, Mining Experience, Number of Hours Worked During the Reporting Week, Primary Work Location, Gender, Race, Ethnicity, Birth Year, and Education Level. Two pages of the form were included, with the first page containing lines for reporting up to 15 employees and the second page containing lines for reporting up to 14 additional employees, or a maximum of 29 sampled employees.
- Final Questions and Comments—This two-page section of the questionnaire included: questions for reporting unusual events or circumstances at the mine during the designated reporting week; the date the questionnaire was completed; the name, title and telephone number of the company representative who should be contacted regarding questionnaire completion; space for entering comments or explanations related to specific responses; and mailing instructions.

The Internet Questionnaire

Beginning in October 2004, a pilot study was conducted to evaluate the recruitment materials, questionnaire and survey procedures developed for the nationwide survey of the mining population. This study allowed OMSHR to explore the feasibility of developing a web-based version of the questionnaire. The pilot study debriefing interview contained several questions to determine whether the mine had access to the Internet, and how convenient this would be for completion of the questionnaire. The majority of respondents indicated that an Internet connection was available at their mine and more than 50 percent reported preferring an electronic response option. Thus, for the National Survey of the Mining Population, a web-based survey was made available. The survey contractor developed the web survey, including programming of the administrative interface, Section 508 compliance, data validation, quality assurance, and programming of the critical questions.

Sample Design and Selection

Definition of the Target Population

The target population for a survey is the entire set of population units about which the survey data are to be used to make inferences. Establishment surveys such as the National Survey of the Mining Population must delineate the level of the business organization that constitutes the units of the target population. Because hazards vary across mines, the target population for this survey was defined in terms of the individual mining operation.

The target population of mines consisted of active mines in current production. The survey was further restricted to operations that were covered under Title 30 of the U.S. Code, specifically mines whose mineral output was sold or used in commerce. The target population of employees was restricted to those mine employees for whom the mine operator must report hours worked using the MSHA Form 7000-2: *Quarterly Mine Employment and Coal Production*

Report (Appendix C). This includes all direct employees working at the mine, but not contract employees brought in periodically or regularly to perform work at the mine.

There is an important temporal aspect to these definitions for mines and for mine operator employees. Over time, some mines will go in and out of operation. Similarly, employees join the mining labor force and leave the labor force over time. Accordingly, the National Survey of the Mining Population focused on mines in operation during a particular calendar quarter and the current employees of those mines.

Construction of the Sampling Frame

The sampling frame for a survey is the list or mechanism used to enumerate target population members for sample selection purposes. Individual sampling frames for each of the five major mining sectors (see Figures 1–5) were constructed using the 2007 second quarter data released by the Mine Safety and Health Administration, so that the sampling frames would be in sync with the actual time period when data collection would begin (the second quarter of 2008). To ensure that any startup or intermittent mining operations would not be missed, all mines reporting zero employment hours were included in these frames. Any mines with a status of abandoned or abandoned/sealed were excluded from the sampling frames. The Standard Industrial Classification (SIC) for the active coal, metal, nonmetal, stone, and sand and gravel mines used in the sampling frames is presented in Appendix D.

Stratification Guidelines

For the National Survey of the Mining Population, mine-level and employee-level analyses were planned, which required adequate sample sizes of mines and of employees. Because multiple employees were to be sampled from each responding mine, sample size requirements for mine-level analyses tended to drive the total number of mines that needed to be sampled. The sample size for employees was determined by the number of sampled mines responding and the average number of employees sampled per mine.

The competing needs of mine-level analysis versus employee-level analysis required the use of a compromise design that supported the objectives of both types of analyses. For mine-level analyses, the best design was one that selected mines with equal probability, while for employee-level analyses the best design was one that selected mines with probability proportional to the number of employees. The compromise design met both needs by stratifying by the number of employees and then sampling mines with equal probability within strata. Strata associated with large mines (in terms of employment) were given greater selection probabilities than small mines, which would facilitate employee-level analyses by making the employee selection probabilities less variable across mines.

Mine size was an important domain for study at the mine level as well as at the employee level. For example, mines might be more likely to vary in their training procedures based upon employee size. Small mines may be more likely to use trainers from outside the organization, while large mines may be more likely to rely on in-house trainers. Hence, stratifying by the number of employees when sampling mines served an analytic purpose, as well as facilitated the over sampling of large mines needed for employee-level analyses (see Figure 6).

From an analysis standpoint, it was also desirable to control for underground versus surface mines when sampling mines and employees (see Figures 7 and 8). Underground coal mines, in particular, have higher injury and fatality rates than surface mines. There is substantial diversity in the incidence of injuries and fatalities at underground mines versus surface mines across all mining sectors. Nearly one-third of coal and metal mines are underground. Less than ten percent of nonmetal and stone mines are underground and sand and gravel mines are surface only. Stratification by underground mines versus surface mines allows for the control over sample sizes needed for effective comparisons of underground mines to surface mines. A more in-depth discussion of the stratum size formation and sample size guidelines used in this survey can be found in Appendix E.

Figure 1. Map of Active Coal Mining Operations for 2007.

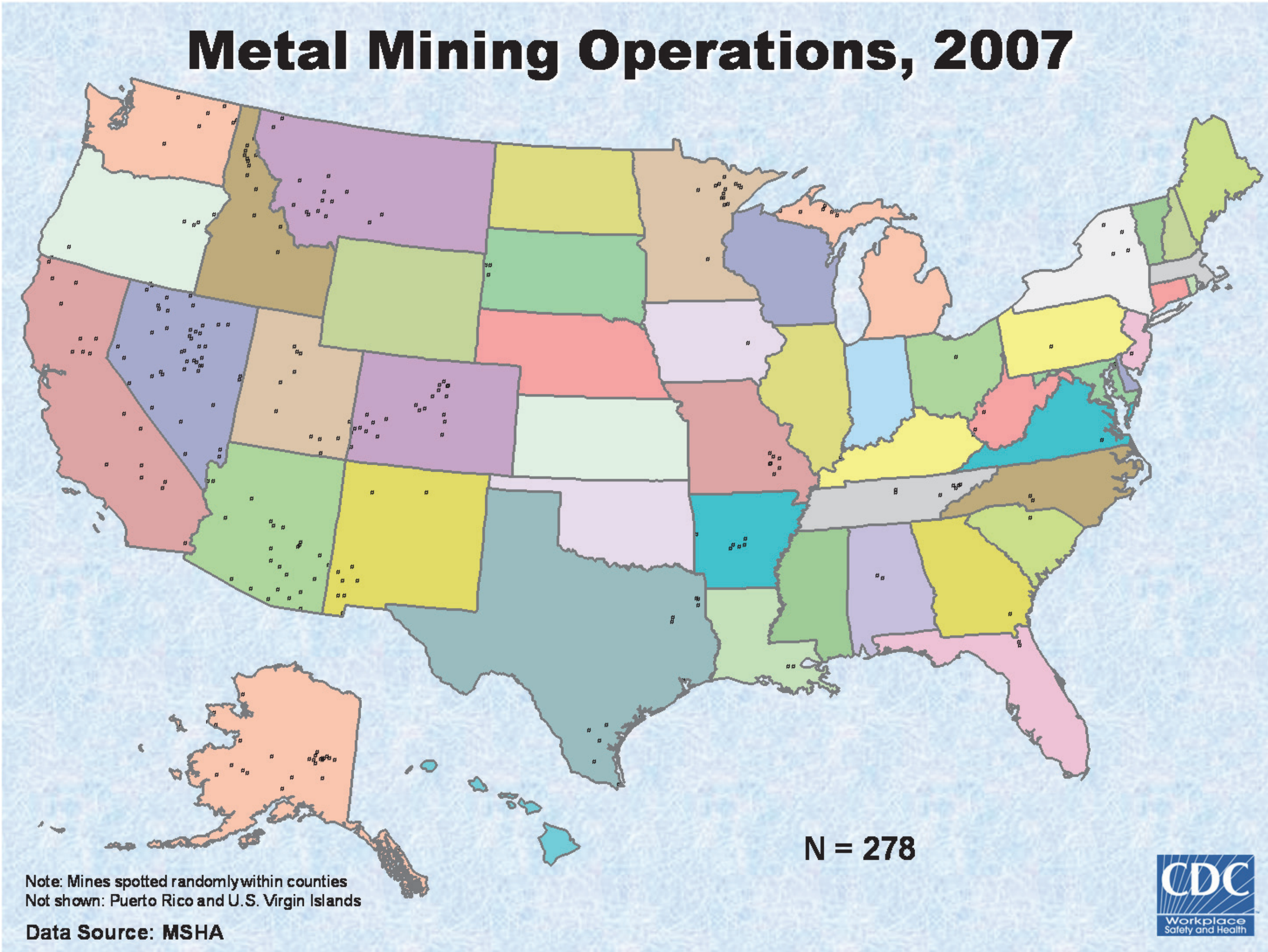

Figure 2. Map of Active Metal Mining Operations for 2007.

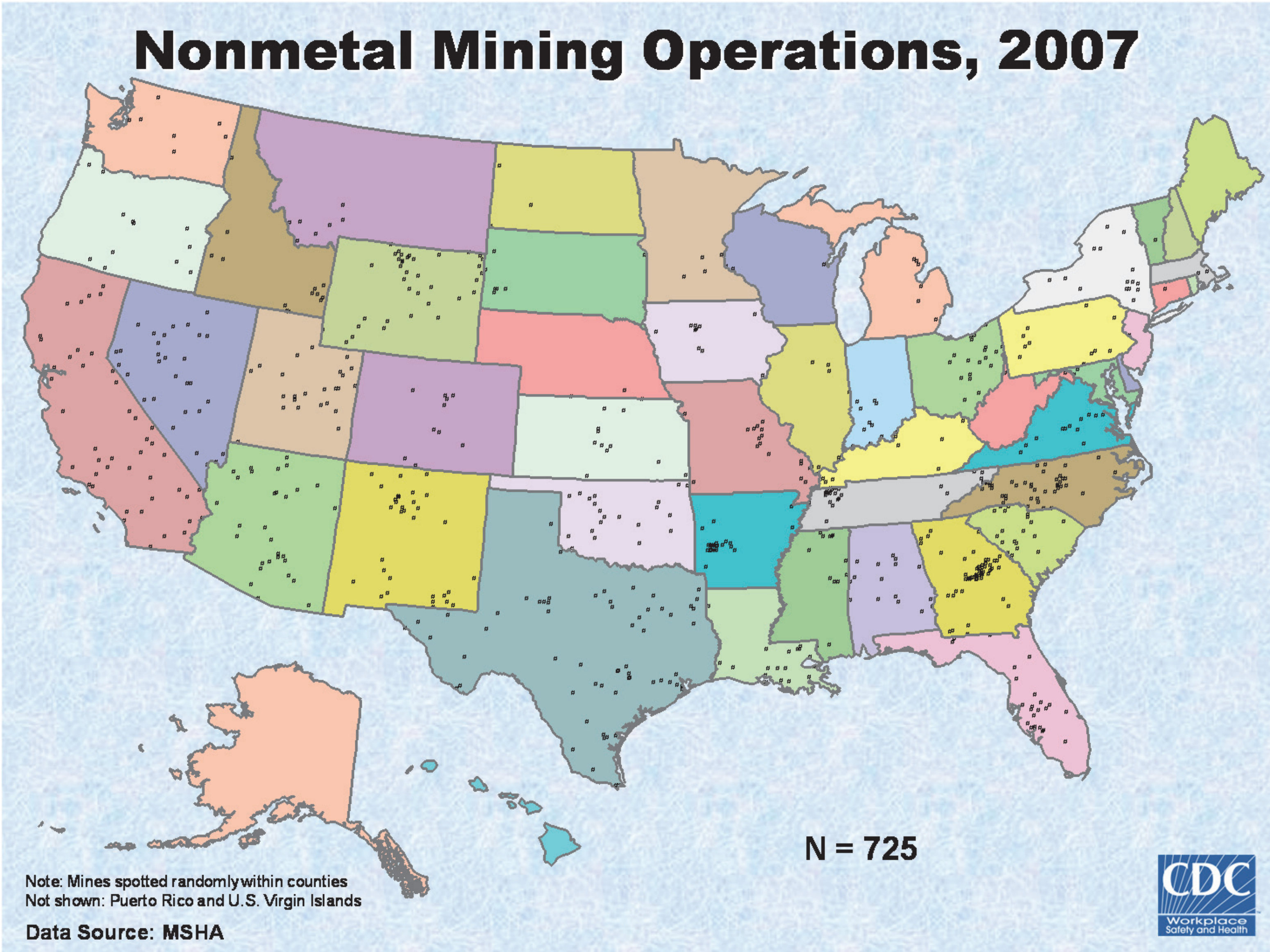

Figure 3. Map of Active Nonmetal Mining Operations for 2007.

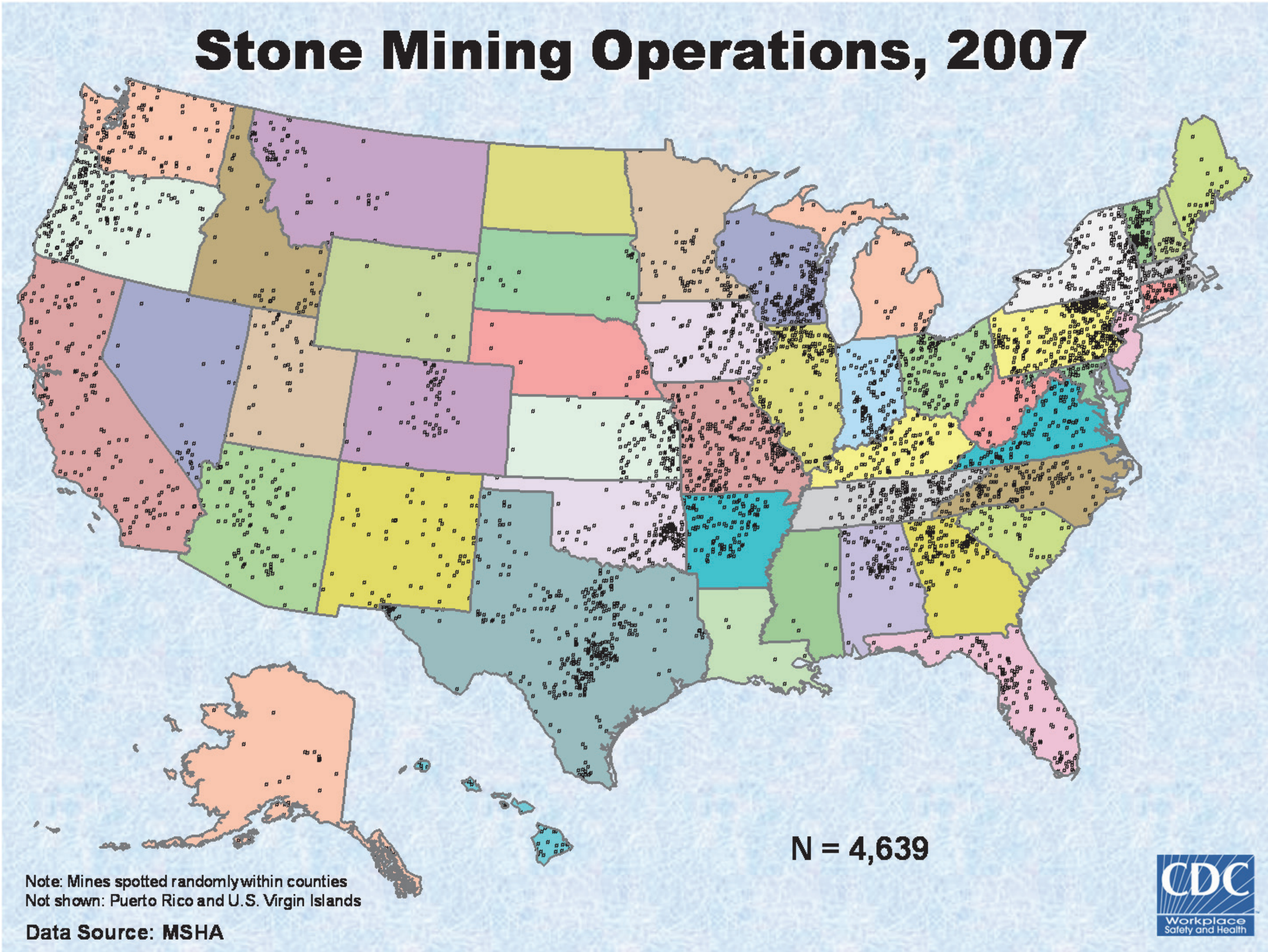

Figure 4. Map of Active Stone Mining Operations for 2007.

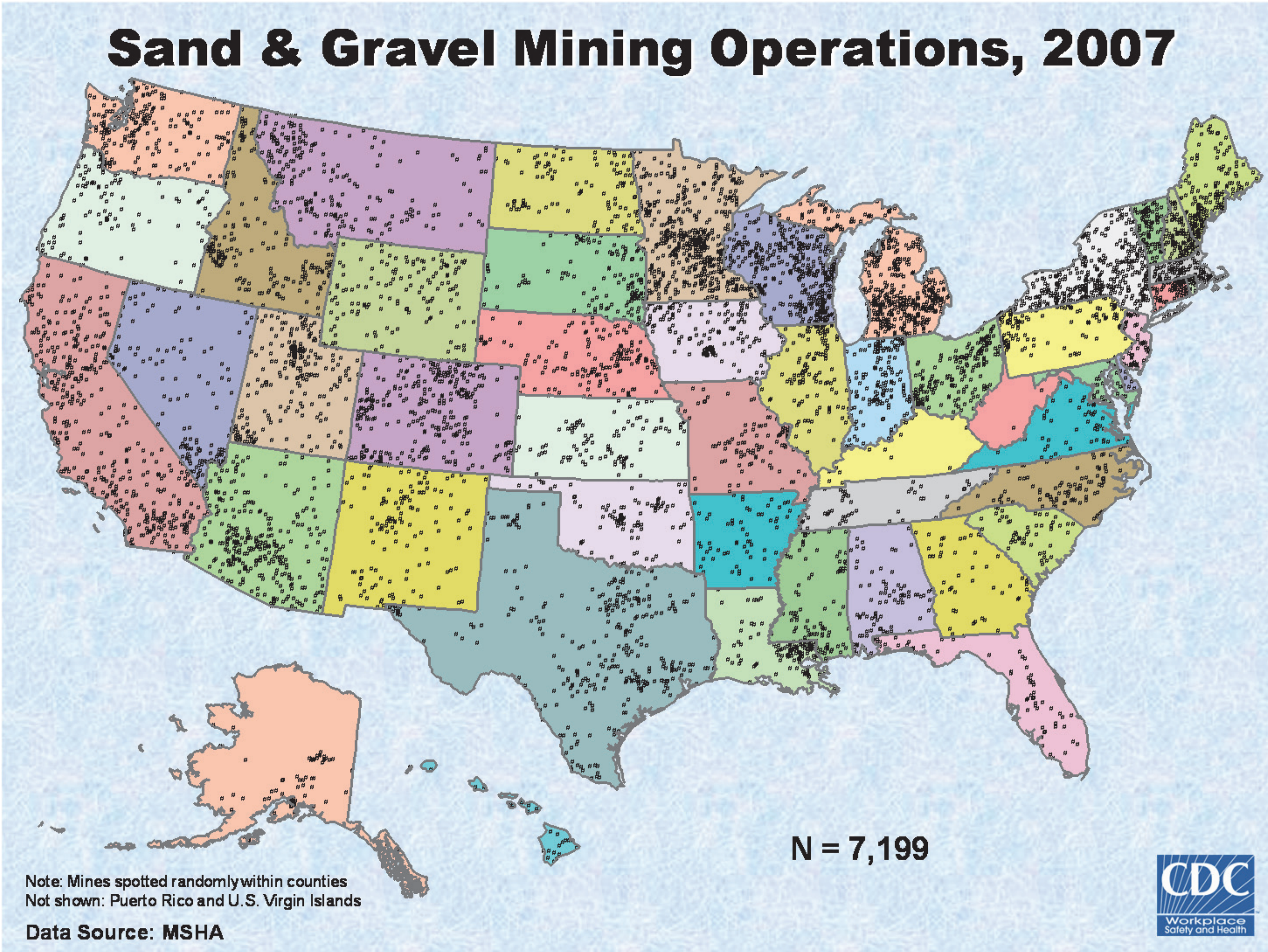

Figure 5. Map of Active Sand and Gravel Mining Operations for 2007.

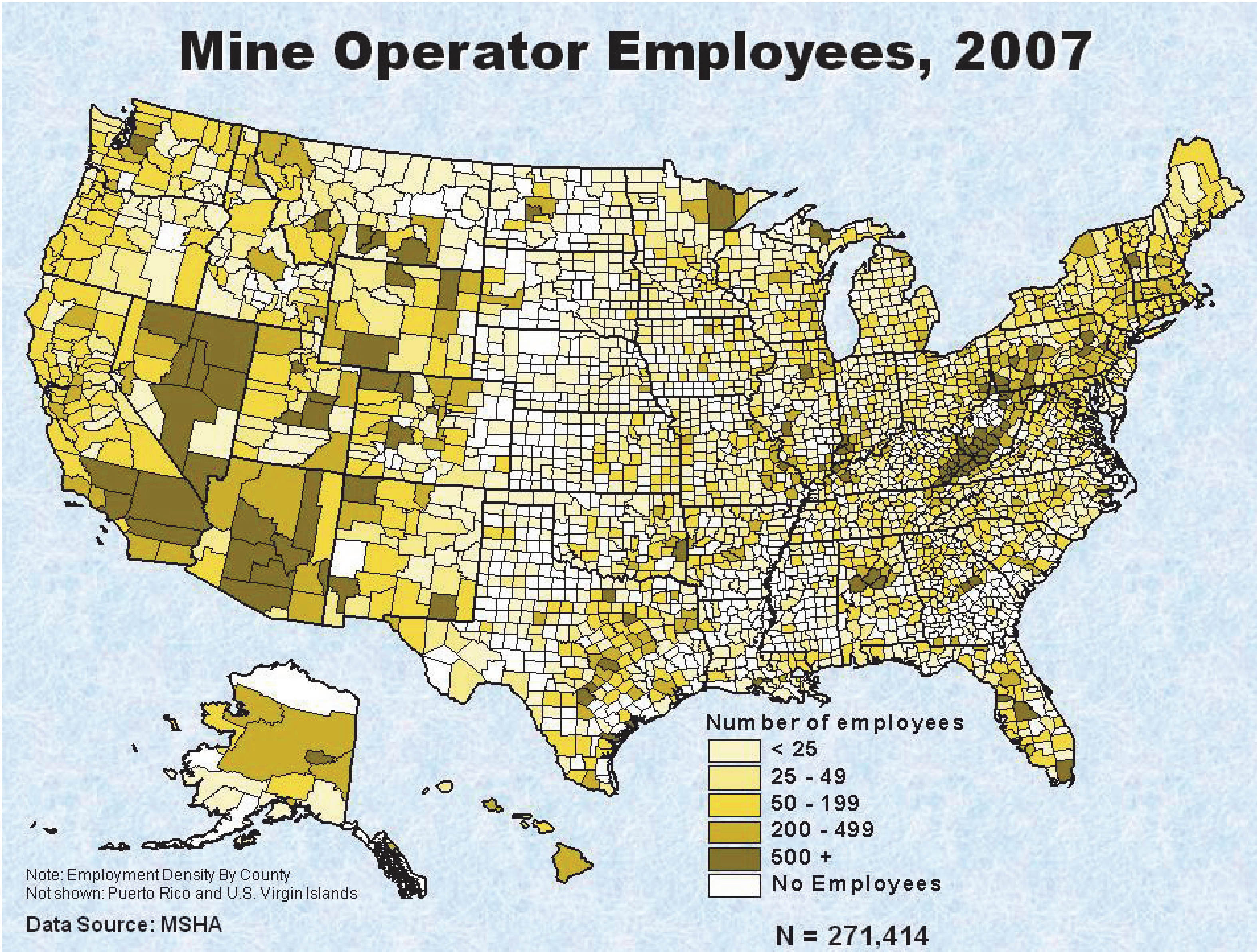

Figure 6. Density Map for Mine Operator Employees for 2007.

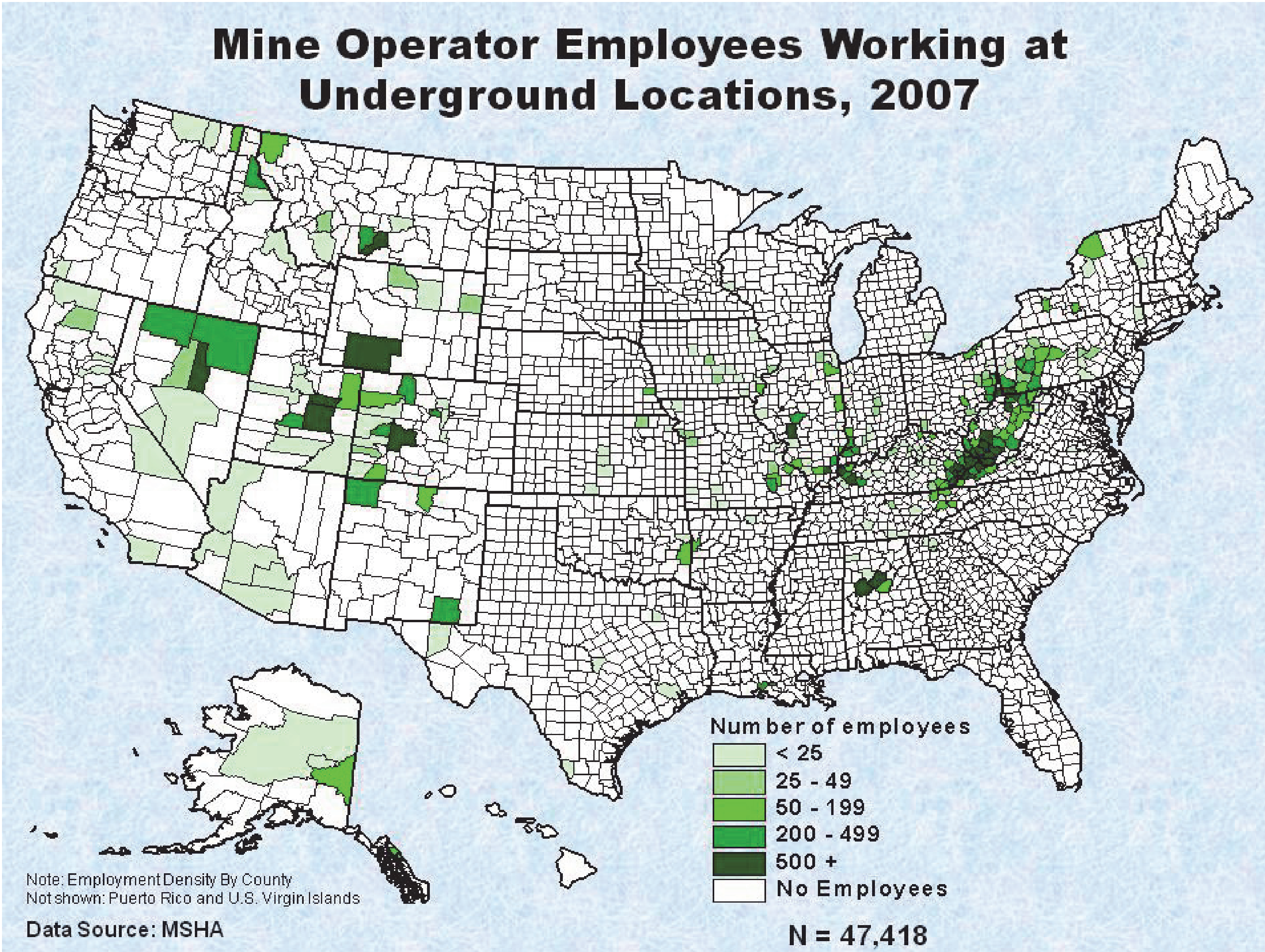

Figure 7. Density Map for Underground Mine Operator Employees for 2007.

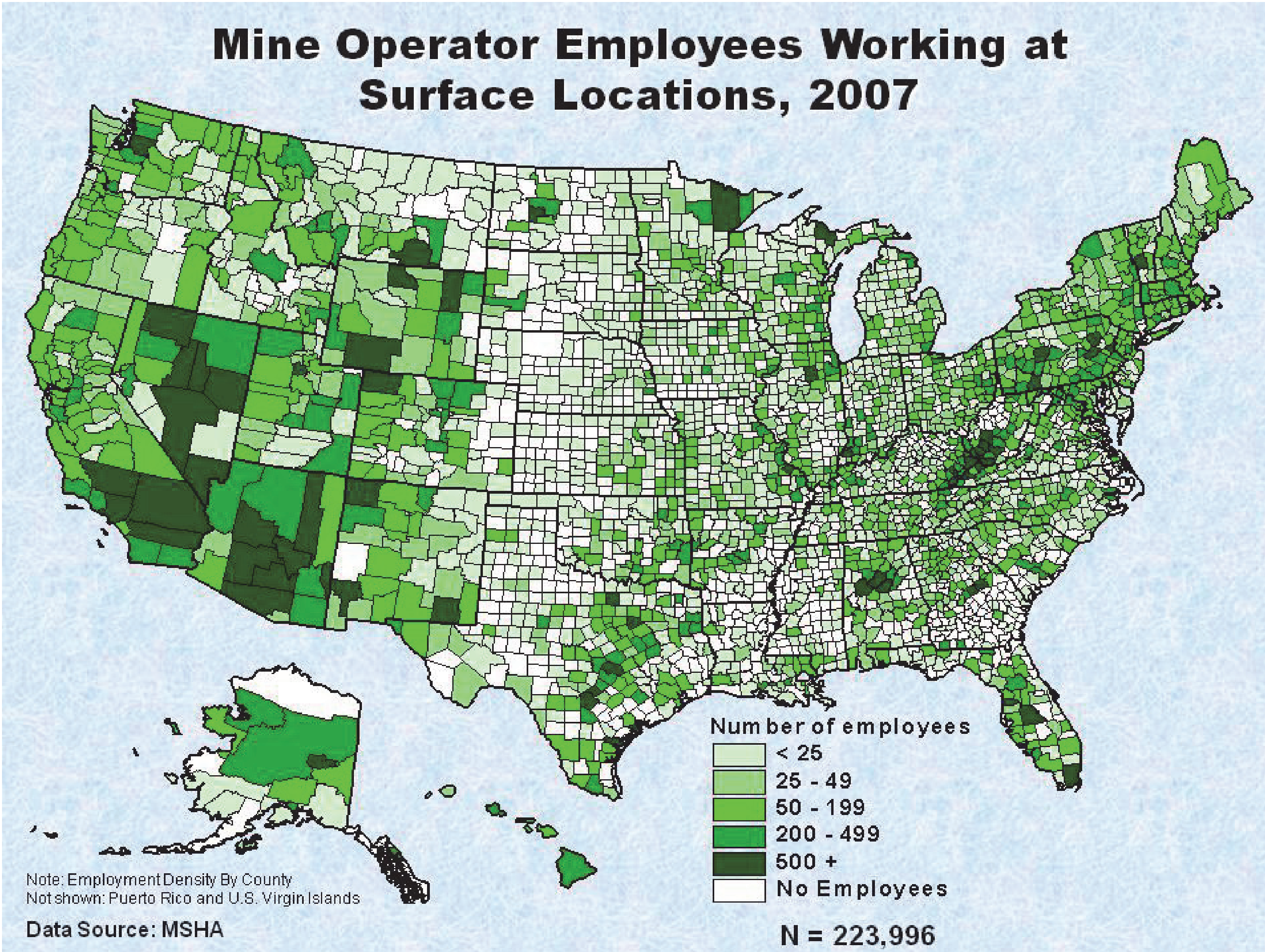

Figure 8. Density Map for Surface Mine Operator Employees for 2007.

Sampling Plans

The original sampling plans were finalized in 2004 after a pretest with eight mining operations. These plans were developed using MSHA data from the second quarter of 2002. The number of actual employees was used to develop these designs rather than the number of full-time equivalent (FTE) employees, because the mine operator would be sampling based upon counts of actual employees, not FTEs. Mines were classified as surface or underground based upon MSHA subunit codes. Mines reporting any employment at underground work locations were classified as underground mining operations.

Because there would actually be two surveys, one for mines and one for employees, the sampling allocation needed to be balanced. An approach that Cochran [1977] suggested was used where the size strata were defined so that they were equal in terms of the square root of the size measure (in this case, the number of employees). The square root was used as a compromise between the needs of mine-level estimation where equal selection probabilities were best (size = 1) and employee-level estimation was best (size = number of employees). Detailed sample size allocation tables based on 2002 data for coal, metal, nonmetal, stone, and sand and gravel mines can be found in Appendix F.

Following the Office of Management and Budget (OMB) approval to conduct the national survey, the final sampling allocations were updated using 2007 second quarter MSHA data. Nine sampling frames were constructed based on the mining sector and mine type (underground or surface). The sampling was conducted using the SurveySelect procedure in the SAS statistical software package (SAS Institute Inc., Cary, NC). Systematic random sampling within the employee size strata was used together with controlled sorting by the state where the mine was located. The latter was done to ensure that the sample of mines was geographically representative. All metal mines and all underground nonmetal mines were selected with certainty from every stratum. The final survey sample of mines consisted of 331 underground coal, 385 surface coal, 74 underground metal, 159 surface metal, 39 underground nonmetal, 286 surface nonmetal, 96 underground stone, 498 surface stone, and 453 sand and gravel, for a total of 2,321 mining operations. Tables 1–9 present the sample allocations by mining sector and mine type.

Table 1. Sample Allocation for Underground Coal Mines

Stratum	Number of Mines	Percentage of Total Mines	Number of Employees	Percentage of Total Employees	Sample Mines
1–9	146	25.4%	331	0.8%	56
10–25	118	20.5%	1,972	4.8%	68
26–50	117	20.3%	4,460	10.8%	67
51–75	58	10.1%	3,622	8.8%	35
76–100	32	5.6%	2,790	6.8%	22
101–250	61	10.6%	9,267	22.5%	49
251+	43	7.5%	18,750	45.5%	34
Total	**575**	**100%**	**41,192**	**100%**	**331**

Table 2. Sample Allocation for Surface Coal Mines

Stratum	Number of Mines	Percentage of Total Mines	Number of Employees	Percentage of Total Employees	Sample Mines
1–9	725	51.8%	2,147	5.7%	101
10–25	302	21.6%	4,945	13.1%	84
26–50	209	14.9%	7,305	19.4%	75
51–75	65	4.6%	4,057	10.8%	36
76–100	30	2.1%	2,612	6.9%	20
101–250	44	3.1%	7,235	19.2%	44
251+	25	1.8%	9,407	24.9%	25
Total	**1,400**	**100%**	**37,708**	**100%**	**385**

Table 3. Sample Allocation for Underground Metal Mines

Stratum	Number of Mines	Percentage of Total Mines	Number of Employees	Percentage of Total Employees	Sample Mines
1–9	26	35.1%	137	1.8%	26
10–25	8	10.8%	134	1.8%	8
26–50	9	12.2%	327	4.3%	9
51–75	7	9.5%	443	5.8%	7
76–100	2	2.7%	168	2.2%	2
101–250	13	17.6%	2,312	30.4%	13
251+	9	12.2%	4,077	53.7%	9
Total	**74**	**100%**	**7,598**	**100%**	**74**

Table 4. Sample Allocation for Surface Metal Mines

Stratum	Number of Mines	Percentage of Total Mines	Number of Employees	Percentage of Total Employees	Sample Mines
1–9	60	37.7%	217	0.9%	60
10–25	21	13.2%	325	1.3%	21
26–50	13	8.2%	454	1.9%	13
51–75	4	2.5%	239	1.0%	4
76–100	3	1.9%	254	1.0%	3
101–250	26	16.4%	4,518	18.7%	26
251+	32	20.1%	18,204	75.2%	32
Total	**159**	**100%**	**24,211**	**100%**	**159**

Table 5. Sample Allocation for Underground Nonmetal Mines

Stratum	Number of Mines	Percentage of Total Mines	Number of Employees	Percentage of Total Employees	Sample Mines
1–9	7	17.9%	30	0.6%	7
10–25	5	12.8%	95	1.9%	5
26–50	6	15.4%	258	5.2%	6
51–75	4	10.3%	257	5.2%	4
76–100	2	5.1%	170	3.5%	2
101–250	11	28.2%	1,980	40.3%	11
251+	4	10.3%	2,125	43.2%	4
Total	**39**	**100%**	**4,915**	**100%**	**39**

Table 6. Sample Allocation for Surface Nonmetal Mines

Stratum	Number of Mines	Percentage of Total Mines	Number of Employees	Percentage of Total Employees	Sample Mines
1–9	339	53.6%	1,305	7.5%	92
10–25	128	20.2%	1,990	11.4%	65
26–50	81	12.8%	3,052	17.6%	46
51–75	32	5.1%	2,026	11.7%	32
76–100	19	3.0%	1,689	9.7%	17
101–250	25	3.9%	3,805	21.9%	25
251+	9	1.4%	3,520	20.2%	9
Total	**633**	**100%**	**17,387**	**100%**	**286**

Table 7. Sample Allocation for Underground Stone Mines

Stratum	Number of Mines	Percentage of Total Mines	Number of Employees	Percentage of Total Employees	Sample Mines
1–9	15	14.0%	78	2.0%	14
10–25	42	39.3%	733	18.8%	32
26–50	30	28.0%	1,030	26.4%	30
51–75	13	12.1%	812	20.8%	13
76–100	2	1.9%	174	4.5%	2
101–250	4	3.7%	511	13.1%	4
251+	1	0.9%	560	14.4%	1
Total	**107**	**100%**	**3,898**	**100%**	**96**

Table 8. Sample Allocation for Surface Stone Mines

Stratum	Number of Mines	Percentage of Total Mines	Number of Employees	Percentage of Total Employees	Sample Mines
1–9	2,034	49.6%	9,039	11.9%	116
10–25	1,345	32.8%	21,224	28.0%	114
26–50	426	10.4%	15,002	19.8%	95
51–75	107	2.6%	6,537	8.6%	51
76–100	56	1.4%	4,903	6.5%	36
101–250	128	3.1%	18,294	24.1%	83
251+	3	0.1%	911	1.2%	3
Total	**4,099**	**100%**	**75,910**	**100%**	**498**

Table 9. Sample Allocation for Sand and Gravel Mines

Stratum	Number of Mines	Percentage of Total Mines	Number of Employees	Percentage of Total Employees	Sample Mines
1–3	2,846	44.3%	5,555	13.0%	119
4–6	1,615	25.1%	7,761	18.2%	80
7–9	729	11.3%	5,682	13.3%	37
10–25	1010	15.7%	14,629	34.4%	110
26–50	190	3.0%	6,411	15.1%	70
51–75	27	0.4%	1,632	3.8%	27
76–100	8	0.1%	684	1.6%	8
101–250	2	0.0%	219	0.5%	2
251+	0	0.0%	0	0.0%	0
Total	**6,427**	**100%**	**42,573**	**100%**	**453**

Data Collection

Survey Packet

The survey packet mailed to each sampled mining operation contained the following materials:

- A cover letter from NIOSH that introduced the study to the selected mines and stressed the importance of the study to the safety and health of miners. The letter was personalized and addressed to the best respondent identified through initial contacts with the mine.
- A Questions and Answers brochure that answered frequently asked questions.
- A copy of the paper questionnaire.
- Personalized directions for accessing the Internet questionnaire.
- A postage-paid return envelope for returning the hard-copy questionnaire.

The mine respondents were given the option of completing either the paper questionnaire booklet or the web-based survey questionnaire. The Questions and Answers brochure explained that both surveys asked the same questions. To minimize the employee-level questionnaire burden, mines with 30 or more employees were asked to provide data for only a sample of the total employees working during the specific reporting week. Mines with less than 30 employees were asked to report for all of them.

For mines with 30 or more employees working in the reference week, the mine respondent was asked to select the sample of employees by following sampling instructions included in the survey questionnaire. The sampling instructions were designed to select from 15 to 25 employees per mine, with employee counts from the frame used to determine the sampling rate. The employees were selected using systematic sampling with custom-generated “start-with” and “take-every” numbers included on the instructions page of the questionnaire. The “take-every” number was determined by dividing the number of employees the mine reported to MSHA by 30 and then rounding down. A random number table was consulted to get a random number between 1 and the “take-every” number which would be the “start-with” number. The “start-with” number constituted the first selection made from the list, prepared by the mine, of employees working during the reference week. The “take-every” number needed to be added repeatedly to the “start-with” number to determine the remaining selections. The variable number of employees selected per mine resulted from the need to use an integer as the “take-every” number to simplify the mathematics for the respondent.

The MSHA employment data printed on the mine’s questionnaire may not have been current for the data collection period. This limitation was handled by instructing the mine respondents to call in when their mine employment for the reference week was 20 percent greater or 20 percent less than the employment projected from the MSHA data. The survey contractor would then provide alternative “start-with” and “take-every” numbers to these mine respondents, after determining that the respondents were reporting for the correct mine.

Each sampled mining operation was randomly assigned a reporting week, balanced by mine type and sector. The reporting week was a seven-day period that the mine respondent was asked to reference when answering some items in the questionnaire. The reporting week was described in the questionnaire as the mine's payroll week, which included the date that was preprinted on the first page of the questionnaire. Over the course of the survey, there were a total of 12 reporting weeks. On average, 193 mines were assigned to each reporting week (see Table 10).

Table 10. Number of Mines in the Final Sample by Sector, Type, and Reporting Week

Week	Total Mines	Coal	Metal	Nonmetal	Stone	Sand and Gravel	Surface	Underground
1	193	59	20	27	50	37	147	46
2	193	60	19	27	49	38	148	45
3	194	60	19	28	50	37	148	46
4	193	60	19	27	49	38	148	45
5	194	60	19	27	50	38	149	45
6	194	60	19	27	50	38	149	45
7	193	59	20	27	49	38	149	44
8	194	60	20	27	50	37	148	46
9	193	60	19	27	49	38	148	45
10	193	59	20	27	49	38	149	44
11	193	59	20	27	49	38	149	44
12	194	60	19	27	50	38	149	45
Total	**2,321**	**716**	**233**	**325**	**594**	**453**	**1,781**	**540**

Survey Promotion

Several initiatives were implemented before the start of data collection to promote the survey and to maximize response rates. OMSHR undertook considerable efforts to publicize the survey. At the start of data collection in March 2008, the National Mining Association offered to prepare and publish an article about the survey in its newsletter. Throughout the data collection period, OMSHR continued to pursue additional publicity efforts, promoting the survey both within NIOSH and to the mining community. A sand and gravel industry newsletter included an article about the survey. A notice about the survey was also published in the May 2008 issue of *CoalUSA* magazine.

Prior to the mailing of the survey packet, initial telephone calls were made to the contacts identified for each selected mine. In some cases the same contact individuals were found to be associated with multiple mines; for example, nine contacts were affiliated with mining companies that each had seven or more mines in the sample. A special effort was made by OMSHR to contact these individuals and inform them of the selection of multiple mining operations, determine the most appropriate addressee/recipient of the survey packet, and encourage participation in the survey. Throughout the data collection period, OMSHR continued to assist the survey contractor in both initiating and receiving calls with mine contacts and in responding to e-mails from the sampled mining operations.

Follow-up Contacts

Once the survey packet had been sent to the contact person at the mine, the data collection schedule provided for a three-week waiting period, to allow the contact the opportunity to complete the survey. After the waiting period, follow-up reminder calls were made to those mines that did not return their questionnaires or complete the web surveys by the "please submit" date printed on the survey. The main functions of the follow-up calls were to:

- Ensure that the survey materials had been received and that the materials were delivered to the appropriate person.
- Answer any questions regarding completing the survey.
- Serve as a reminder to complete the survey.

The most difficult challenge of follow-up was simply reaching the contacts. To deal with this issue, various approaches and initiatives were implemented. Because e-mail addresses were often available for mine contacts, an e-mail initiative was developed whereby an e-mail reminder was sent to anyone who had: (1) started, but did not complete a web survey; (2) not yet opened a web survey; (3) not returned a questionnaire; or (4) not made contact during the follow-up calls. This resulted in some immediate responses to the e-mails, along with many calls to the toll-free study telephone line and directly to OMSHR, often from contact persons who had a question on how to complete the survey. There were also a number of out-of-office replies that were useful in determining when another follow-up attempt could be made.

In addition, OMSHR also prepared a follow-up letter, cosigned by the study project director and the director of the NIOSH Office of Mine Safety and Health Research, with space at the bottom for the web survey login information and mine-specific password. This letter was mailed to contacts at more than 1,000 mining operations. As a result, OMSHR received some additional completed questionnaires. However, a large number of letters were returned as undeliverable.

Data Imputation and Statistical Weighting Procedures

A questionnaire was considered completed if it was missing no more than two of the 52 critical items listed in Appendix G. Returned questionnaires with more than two missing critical items were considered partially complete and, when possible, data imputation was used to complete these missing items.

Data Imputation

Imputation is the process of replacing missing data with legitimate values derived through logical deduction, regression models, or other probabilistic means. For the National Survey of the Mining Population, an attempt was made to impute missing data for the questions in the Training; Prep Plant/Mill Workers (found in the Work Schedules and Shift Work sections); Independent Contractor Employees; Safety, Communication, and Rescue Measures; and Employee Length of Service sections of the questionnaire. The Prep Plant/Mill Workers questions were imputed via information retrieved from the MSHA data on mines not having a preparation plant. In these cases, the relevant questionnaire items were set equal to zero or to the "not applicable" response. The questions in the Training; Independent Contractor Employees; and Safety, Communication and Rescue Measures sections were imputed via logical deduction, that is, when one or more responses were affirmative within the section and no negative responses were recorded, all missing items were set to the negative response. The Employee Length of Service section was completed via a regression model that predicted one or more missing items for the Total Years in this Job Title, Total Years at this Mine, and Total Years in Mining questions from those of the three that were reported.

Data Weighting, Estimation, and Variance Estimation

Sample survey data are weighted in order to provide unbiased or nearly unbiased estimates. The weights take into account variable probabilities of selection as well as compensate for bias introduced by differences between respondents and nonrespondents. For the National Survey of the Mining Population, weights were calculated in two steps. First, a base weight was calculated as the reciprocal of a given mine's probability of selection. These probabilities varied by major mining sector (coal, metal, nonmetal, stone, and sand and gravel), mine type (underground or surface), and mine size (number of employees). Second, a nonresponse adjusted weight was calculated as the product of the base weight and a nonresponse adjustment factor. The nonresponse adjustment factor was calculated as the ratio of the sum of weights for all eligible mines within a primary stratum (sector by mine type) to the sum of the weights for all responding mines.

Survey sampling implies some imprecision in the estimates and this imprecision is measured as variance and standard errors. For this survey, the Jackknife Repeated Replication (JRR) method was used to support variance estimation. One hundred replicate weights were created for each record in the dataset, with every replicate weight repeating the two steps described previously. Each replicate weight was used to derive a replicate estimate, and the variance in the replicate estimates (across the 100 replicates) could then be used to estimate the variance and standard error of each survey estimate.

Lessons Learned

The following lessons learned are based on project staff observations (by both OMSHR and the survey contractor) and the feedback obtained from the survey respondents. Also presented are any additional methods that could have been implemented to potentially increase the response rate or the efficiency of the study management.

- The questionnaire, with its foldout employee section and sample selection approach, appeared to be a barrier to completion. It is possible that the perceived level of effort for completing the survey prevented some mines from participating.
- Comments regarding ease of use of the survey were similar for both paper and web-based respondents. Partial responses on both versions of the questionnaire often stopped at the beginning of the employee section. This may have occurred when the mine contact realized that he/she could not complete the full questionnaire without retrieving

information from other people in the mine organization, or from records not conveniently located, or that other staff may have been unable or unwilling to complete the questionnaire.

- There was no incentive provided for completion of the survey, other than to assist OMSHR.
- Most refusal information related to time/burden issues. Some contacts refused after learning that they were assigned to complete questionnaires for multiple mines in their organization. Health and safety contacts often said that the survey content focused too little on health and safety issues and too much on human resource questions.
- The e-mail follow-up reminders and OMSHR follow-up letter were helpful initiatives, but may have been more effective had they been initiated at an earlier time in the data collection process.
- Even though multiple contact attempts and various response modes were used in this survey, conducting a nonresponse survey could have helped to ascertain whether the population of nonresponders differed measurably from the participants. It also could have been very useful in understanding and characterizing barriers to participation.
- Some suggestions for future surveys are the following:
    - Conducting the survey to focus on one major mining sector at a time in order to improve performance.
    - Reducing the length of the questionnaire, in response to complaints from mines that did not have the staff or the time to complete it.
    - Involving large mining companies in early reviews of the survey to obtain their input on questions they might find objectionable and their feedback on how to best administer the survey.

Survey Results

Overall, 954 completed or partial surveys were returned from the sampled mining operations. The outcomes of data collection for each of the sampled mines are summarized in Table 11. The 651 “critical items complete” and 86 “final missing critical items” questionnaires were the 737 survey responses that were used for the estimates presented in this IC. The mode of completion by the respondents is shown in Table 12.

Table 11. Summary of Final Results for All Sampled Mines

Result Code Description	Total
Critical items complete *	651
Final missing critical items *	86
Partial response	217
Final refusal—explicit refusal by corporate management	56
Final refusal, other reason—explicit refusal by local mine management	77
Final refusal, records unavailable—explicit refusal by local mine management	5
Final refusal, staff time—explicit refusal by local mine management	85
Ineligible mine	85
Ineligible, no contact	32
Initialized, no response	1,020
Hard-copy questionnaire received, but blank	7
Total	**2,321**

*Comprised final survey dataset

Table 12. Number of Completed Surveys by Mode

Mode	Count	Percentage
Web questionnaire	360	49%
Paper questionnaire	377	51%
Total	**737**	**100%**

Based on the review of the results of all contact attempts, 117 mines were determined to be ineligible. A summary of the ineligible mines by sector is presented in Table 13. Some of the reasons for ineligibility were:

- Mine has been closed.
- No contact was ever made with anyone at the mine.
- Mine is nonproducing.
- Construction work on the mine has not yet begun.
- Mine is shutting down and moving out equipment.
- Mine was just an exploration mine and was never in a producing status.
- Mine contracts out all of its mining operations.

Table 13. Summary of Ineligible Mines by Sector

Mine Sector	Ineligible Mine	Ineligible No Contact	Total
Coal	53	14	67
Metal	10	7	17
Nonmetal	9	4	13
Stone	7	3	10
Sand and Gravel	6	4	10
Total	**85**	**32**	**117**

Refusals to participate in the survey were received from 223 mines. The major reasons for refusal are shown in Table 14.

Table 14. Summary of Refusal by Mine Sector and Type of Refusal

Reason for Refusal	Coal	Metal	Nonmetal	Stone	Sand and Gravel	Total
Corporate refusal	20	1	11	16	8	56
General refusal	18	7	13	23	16	77
Records unavailable	1	3	0	0	1	5
Staff time	27	8	12	16	22	85
Total	**66**	**19**	**36**	**55**	**47**	**223**

The overall weighted response rate for the survey was 36.7 percent, with the lowest response rate for coal mines (25.8 percent) and the highest for nonmetal mines (48.8 percent). Underground mines responded at 30.1 percent compared to surface mines at 37.1 percent. The response rate data are presented in Figure 9.

The weighted response rates were calculated as the ratio of the sum of the weights of responding mines divided by the sum of the weights for all eligible sampled mines. The denominator included all nonresponding mines that were known to be eligible along with a percentage, *p*, of the weight corresponding to mines which did not respond but for whom it was not possible to determine whether in fact they were eligible. The percentage, *p*, was computed as the ratio of the weights of known eligible nonrespondents, plus respondents, plus ineligible mines. The ratios were computed separately for each nonresponse adjustment cell, which was defined by sector, mine type, and mine size.

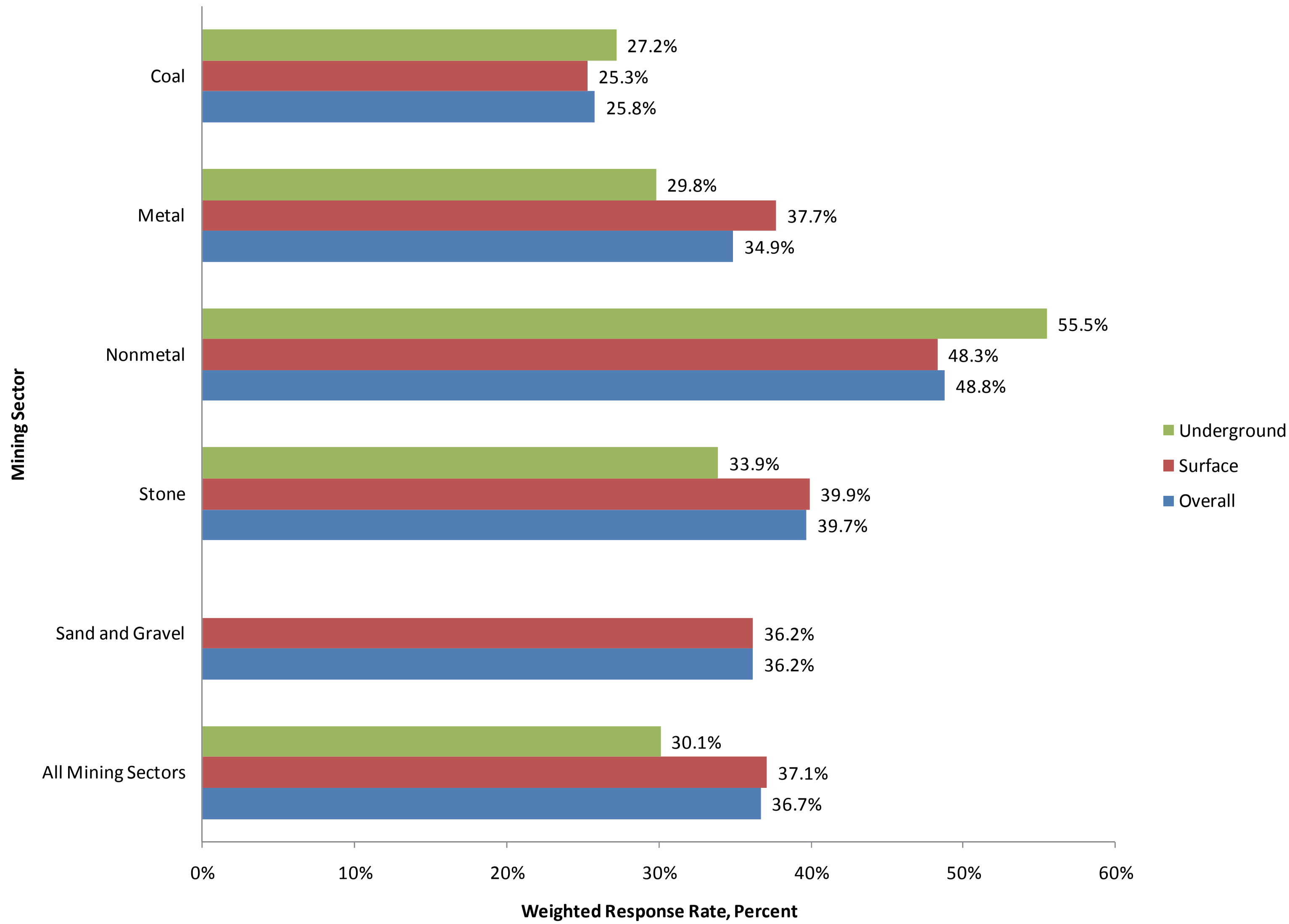

Figure 9. Weighted Response Rates by Sector and Mine Type.

Based on the data collected in this survey, Table 15 represents national estimates of the number of mines and the mine operator employees (with associated 95 percent confidence intervals) by sector during a typical week in the spring/summer of 2008. There were an estimated 231,549 employees working in 12,321 mines. Of these employees, 53,326 worked in 668 underground mines and the remaining 178,222 worked in 11,654 surface mines.

Table 15. National Estimates of Mines and Mine Employees in Spring/Summer 2008

Mine Sector	Number of Mines*	95% CI	Number of Employees*	95% CI
Coal, underground	454	(411, 498)	38,290	(31,088, 45,492)
Coal, surface	1,053	(925, 1,181)	31,717	(23,810, 39,625)
Metal, underground	71	(62, 79)	8,653	(2,419, 14,887)
Metal, surface	130	(113, 147)	30,430	(9,332, 51,528)
Nonmetal, underground	38	(29, 47)	3,424	(1,919, 4,928)
Nonmetal, surface	577	(506, 647)	15,925	(10,668, 21,182)
Stone, underground	105	(92, 118)	2,959	(2,491, 3,427)
Stone, surface	3,852	(3,600, 4,104)	68,006	(62,641, 73,372)
Sand and Gravel	6,042	(4,774, 7,309)	32,144	(26,275, 38,013)
Total	**12,321**	**(11,003, 13,640)**	**231,549**	**(204,685, 258,413)**

*Data do not sum to total due to independent rounding.

Statistical Analysis

The statistical analysis of the data from the National Survey of the Mining Population was conducted using the SAS statistical software package. The SAS SURVEYFREQ and SURVEYMEANS procedures were used to create the weighted summary statistics that are reported in the IC. These procedures properly analyze data from complex sample surveys by taking the sample design into account. The variance estimation method used with these data was the Jackknife Repeated Replication (JRR). At this time, the subpopulation analysis for JRR is not available in SAS 9.2. In order to provide national estimates for the coal, metal, nonmetal, stone, and sand and gravel mining sectors, a SAS macro, using a reweighting method, proposed by Wang and Waldron [2010] was adopted for these subpopulation analyses. In their paper, Wang and Waldron compared the results of a subgroup analysis using their macro with PROC SURVEYMEANS and found these results were almost identical to those obtained when using the standard subpopulation analysis procedure in both the Stata 10.0 (StataCorp LP) and SUDAAN 10 (RTI International) statistical analysis software packages. In order to provide a measure of precision, a 95 percent confidence interval (CI) has been calculated for all survey estimates reported in this IC. Data were suppressed, and no national estimates were computed when the unweighted survey count was fewer than five responses (i.e., the number of responses was too small to be able to produce a reliable estimate) [NCHS 2002, 2004].

Mine Statistics for All Mines

Summary of Mine Statistics for All Mines

The data for training and non-English languages can be found in Tables 16–19. For the U.S. mining industry, the weighted survey estimates indicate that more training is conducted by the mine's employees including: annual refresher training (70.5 percent); newly hired inexperienced miner training (64.3 percent); and newly hired experienced miner training (60.5 percent) when compared to the mine's use of outside trainers. Lectures (87.6 percent), written materials (85.0 percent) and videos (79.0 percent) are the top three methods and materials used for training. Estimates from the survey indicate that 40.1 percent of all mines have employee safety meetings once a week. Overall, approximately seven percent of mine employees use a language other than English.

Tables 20 and 21 present the national estimates for work schedules and shift work. The average number of hours worked per week is 39.2 for production workers, 38.6 for production support workers, and 39.7 for preparation plant/mill workers. The majority of mines operate one shift per day (76.9 percent for production workers, 81.9 percent for production support workers, and 65.7 percent for preparation plant/mill workers).

National estimates for independent contractor employees are presented in Table 22. During a typical week, mines use independent contractor employees for various types of work including: drilling and blasting (11.2 percent); construction or reconstruction of mine facilities (8.9 percent); equipment service or repair of equipment on mine property (7.5 percent); and material handling (5.8 percent).

Tables 23–26 present national estimates for safety, communication, and rescue measures. Cell phones (88.6 percent) are the most frequently used communication system followed by hand-held two-way radios (62.1 percent), and dedicated telephones (40.1 percent). Forty-eight percent of mines use telephones for emergency early warnings. Eight percent of mines report having their own mine rescue team composed of approximately eight team members. The majority of mine rescue teams train on an annual basis (54.6 percent).

Table 16. Miner Training Within the Past 12 Months at All Mines

Training Conducted by	Percentage of Mines	95% CI
Mine employees		
Annual miner refresher	70.5	(66.7, 74.2)
Newly hired inexperienced miner	64.3	(59.7, 68.9)
Newly hired experienced miner	60.5	(56.2, 64.8)
Outside trainer		
Annual miner refresher	58.5	(53.2, 63.8)
Newly hired inexperienced miner	19.6	(16.3, 22.9)
Newly hired experienced miner	15.5	(10.9, 20.1)
Outside contract trainer		
Annual miner refresher	51.1	(45.6, 56.5)
Newly hired inexperienced miner	58.0	(46.2, 69.8)
Newly hired experienced miner	65.4	(53.5, 77.4)
Outside state grantee		
Annual miner refresher	36.2	(28.0, 44.4)
Newly hired inexperienced miner	38.3	(23.1, 53.5)
Newly hired experienced miner	29.2	(11.4, 46.9)
Outside other trainer		
Annual miner refresher	17.2	(12.5, 21.9)
Newly hired inexperienced miner	8.4	(4.9, 12.0)
Newly hired experienced miner	12.4	(3.4, 21.3)

Notes: Data are national estimates; multiple responses permitted.

Table 17. Frequency of Periodic Safety Meetings at All Mines

Response	Percentage of Mines	95% CI
Less than once a year	1.9	(0.9, 2.9)
Annually	5.0	(2.9, 7.2)
Less than once a month	8.8	(6.3, 11.4)
Once a month	21.3	(17.1, 25.4)
Once every 2 weeks	6.6	(3.9, 9.4)
Once a week	40.1	(33.6, 46.7)
Several times a week	6.7	(4.6, 8.9)
Daily	9.5	(5.9, 13.0)

Note: Data are national estimates.

Table 18. Employee Safety Training Materials and Methods at All Mines

Response	Percentage of Mines	95% CI
Lectures	87.6	(84.7, 90.5)
Written materials	85.0	(81.2, 88.9)
Videos	79.0	(75.9, 82.0)
Self-guided interactive computer programs	17.3	(12.6, 22.0)
Demonstrations	62.8	(56.7, 68.9)
Hands-on training exercises	65.6	(60.9, 70.4)
Group exercises (role playing, games, problem solving)	33.4	(29.8, 36.9)
Classroom simulations (e.g., virtual reality)	11.9	(9.5, 14.4)
Worksite simulations	32.3	(27.7, 36.9)
Narrative storytelling	46.5	(41.3, 51.7)
Other	3.2	(1.8, 4.6)

Notes: Data are national estimates; multiple responses permitted.

Table 19. Non-English Languages at All Mines

Response	Percentage	95% CI
Employees use a language other than English to communicate	7.3	(4.8, 9.9)
Mining operations provide training materials, signs, or written materials, in language(s) other than English	20.3	(15.7, 24.9)
Language(s) provided[1]		
Spanish	99.7	(99.2, 100.0)
Other	DSU	DSU
Helpful to have training materials, signs, or written materials in other languages, in addition to those already provided	32.6	(19.2, 46.0)
Helpful to have training materials, signs, or written materials in language(s) other than English	9.8	(7.2, 12.5)

[1]Multiple responses permitted. Abbreviation: DSU, data suppressed.
Note: Data are national estimates.

Table 20. Work Schedules at All Mines

Response	Production Workers	95% CI	Production Support Workers	95% CI	Preparation Plant/Mill Workers	95% CI
Scheduled days per week (average)	4.8	(4.8, 4.9)	4.9	(4.8, 5.0)	4.9	(4.8, 5.0)
Scheduled hours per day (average)	9.1	(8.9, 9.3)	9.7	(8.7, 10.7)	9.1	(8.8, 9.5)
Actual hours worked per week (average)	39.2	(37.5, 40.9)	38.6	(36.7, 40.5)	39.7	(36.0, 43.5)
Work crews change shifts at active mining site (percentage)	12.1	(9.9, 14.2)	11.1	(8.1, 14.2)	NA	NA
Average time spent traveling to and from active mining site while being paid (hours)	1.6	(1.5, 1.7)	1.6	(1.5, 1.7)	NA	NA

Abbreviation: NA, not applicable. Note: Data are national estimates.

Table 21. Shift Work Schedules at All Mines

Response	Production Workers Percentage of Mines	95% CI	Production Support Workers Percentage of Mines	95% CI	Preparation Plant/Mill Workers Percentage of Mines	95% CI
Number of shifts per day						
1 shift	76.9	(73.4, 80.4)	81.9	(77.7, 86.2)	65.7	(58.2, 73.1)
2 shifts	18.7	(15.4, 22.1)	13.3	(9.6, 17.0)	23.0	(16.5, 29.6)
3 shifts	2.8	(1.9, 3.7)	4.6	(3.1, 6.1)	10.3	(7.6, 12.9)
4 shifts	1.6	(1.3, 1.9)	DSU	DSU	DSU	DSU
Rotating shifts	7.7	(5.6, 9.8)	5.9	(4.1, 7.8)	11.5	(8.0, 15.0)
Frequency workers rotate shifts						
Weekly	62.3	(50.4, 74.2)	59.1	(45.0, 73.2)	51.0	(35.6, 66.3)
Twice a month	20.7	(13.6, 27.8)	19.1	(10.7, 27.6)	17.1	(8.8, 25.4)
Monthly	DSU	DSU	DSU	DSU	15.9	(1.0, 30.8)
Other	5.5	(2.1, 8.9)	9.3	(3.9, 14.8)	16.0	(2.6, 29.4)
Direction the shift rotates						
Clockwise (day—afternoon—night)	75.3	(67.0, 83.7)	68.4	(56.9, 79.9)	67.0	(53.7, 80.2)
Counterclockwise (night—afternoon—day)	6.4	(2.5, 10.3)	13.0	(6.3, 19.8)	11.1	(4.5, 17.6)
Other	18.2	(11.1, 25.4)	18.6	(9.0, 28.1)	21.9	(8.8, 35.1)
Unique work shifts	4.0	(2.3, 5.6)	3.4	(1.8, 4.9)	4.6	(2.3, 7.0)

Abbreviation: DSU, data suppressed. Note: Data are national estimates.

Table 22. Activities of Independent Contractor Employees During the Reporting Week at All Mines

Response	Percentage of Mines Reporting Contractors	95% CI	Average Number of Contractor Employees	95% CI	Average Total Hours	95% CI
Mine development	2.1	(1.0, 3.2)	8.5	(4.4, 12.7)	217.1	(65.2, 369.0)
Construction or reconstruction of mine facilities	8.9	(6.3, 11.5)	10.9	(5.4, 16.3)	298.5	(110.8, 486.3)
Demolition of mine facilities	0.2	(0.0, 0.4)	50.4	(0.0, 148.0)	DSU	DSU
Construction of dams	DSU	DSU	DSU	DSU	DSU	DSU
Excavation or earthmoving activities (involving mobile equipment)	5.5	(3.7, 7.3)	6.9	(4.3, 9.6)	234.5	(132.2, 336.8)
Equipment installation	2.4	(1.1, 3.7)	7.1	(0.0, 14.7)	309.2	(0.0, 693.2)
Equipment service or repair of equipment on mine property (exceeding 5 consecutive days)	7.5	(5.3, 9.6)	5.0	(0.9, 9.1)	121.7	(54.0, 189.4)
Material handling (within mine property)	5.8	(4.1, 7.6)	8.0	(5.5, 10.6)	214.4	(138.4, 290.4)
Drilling and blasting	11.2	(8.8, 13.5)	3.0	(2.3, 3.8)	66.3	(34.9, 97.7)
Production support work	2.2	(1.3, 3.1)	9.5	(5.6, 13.4)	367.1	(169.8, 564.4)
Mineral extraction	1.2	(0.5, 2.0)	4.7	(1.6, 7.9)	173.4	(40.9, 305.8)
Other work	1.2	(0.6, 1.9)	9.7	(2.9, 16.5)	294.4	(23.4, 565.5)

Abbreviation: DSU, data suppressed. Note: Data are national estimates.

Table 23. Communication Devices and Systems at All Mines

Response	Percentage of Mines	95% CI
Dedicated telephones	40.1	(34.6, 45.7)
Mine page phones	8.5	(6.6, 10.4)
Trolley phones	DSU	DSU
Shaft or hoist phones	0.8	(0.4, 1.2)
Cell phones	88.6	(85.8, 91.4)
Voice over internet protocol (VOIP) phones	1.0	(0.4, 1.5)
Hand-held two-way radios	62.1	(57.1, 67.2)
Wireless paging devices	4.6	(2.7, 6.5)
Leaky feeder communications system (not running a PED)	1.6	(1.0, 2.1)
Personal emergency device (PED) cap lamp/pager	0.9	(0.0, 2.0)
Through-the-Earth (TTE) technology (other than a PED)	DSU	DSU
Inductive coupled radios	2.1	(1.0, 3.1)
Ethernet	3.9	(2.5, 5.3)
TRACKER tagging system	0.6	(0.2, 1.0)
Longwall face communication systems	0.4	(0.1, 0.6)
None of the above	1.5	(0.7, 2.4)
Other	19.2	(14.3, 24.0)

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 24. Personal Locators, Trackers, and Devices at All Mines

Response	Percentage of Mines	95% CI
Electronic or computerized tagging or tracking	0.7	(0.3, 1.1)
Tag boards	7.9	(6.5, 9.2)
Reflective vests/clothing	36.2	(29.4, 43.1)
Chemical light sticks	2.5	(1.3, 3.8)
Lighted vests	1.7	(0.9, 2.5)
Laser lights/pointers	DSU	DSU
Strobe lights	10.9	(7.3, 14.5)
None of the above	56.7	(49.4, 63.9)
Other	4.9	(2.9, 6.8)

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 25. Emergency Early Warning Methods at All Mines

Response	Percentage of Mines	95% CI
Stench gas	0.6	(0.4, 0.8)
Audible systems	31.0	(27.6, 34.5)
Visual systems	15.2	(11.5, 18.9)
Pager phones	8.1	(6.0, 10.3)
Telephones	48.3	(44.3, 52.4)
Messengers	13.9	(8.2, 19.6)
Electronic personal communication systems	2.1	(0.7, 3.6)
None of the above	26.6	(20.7, 32.6)
Other	16.3	(12.2, 20.4)

Notes: Data are national estimates; multiple responses permitted.

Table 26. Rescue Teams at All Mines

Response	Percentage of Mines	95% CI
Mine has own rescue team	8.2	(5.1, 11.3)
Average number of rescue team members	7.8	(6.1, 9.5)
Frequency of team training		
Less than once a year	DSU	DSU
Annually	54.6	(32.6, 76.6)
Less than once a month	2.6	(0.5, 4.7)
Once a month	30.4	(16.6, 44.2)
Once every 2 weeks	3.2	(0.3, 6.2)
Once a week	DSU	DSU
Other time interval	DSU	DSU

Abbreviation: DSU, data suppressed. Note: Data are national estimates.

Mine Statistics for All Underground Mines

Summary of Mine Statistics for All Underground Mines

The data for training and non-English languages can be found in Tables 27–30. For all underground mines, the weighted survey estimates indicate that more training is conducted by the mine's employees including: annual refresher training (75.2 percent), newly hired inexperienced miner training (69.8 percent), and newly hired experienced miner training (83.1 percent) when compared to the mine's use of outside trainers. Lectures (97.3 percent), written materials (92.0 percent), and demonstrations (85.4 percent) are the top three methods and materials used for training. Estimates from the survey indicate that 47.8 percent of underground mines have safety meetings once a week. Approximately four percent of underground mine employees use a language other than English.

Tables 31 and 32 present the national estimates for work schedules and shift work. The average number of hours worked per week is 42.9 for production workers, 41.8 for production support workers, and 42.7 for preparation plant/mill workers. The majority of underground mines operate two shifts per day for production workers (46.7 percent) and preparation plant/mill workers (38.1 percent) and one shift per day for production support workers (58.0 percent).

National estimates for independent contractor employees are presented in Table 33. During a typical week, underground mines use independent contractor employees for various types of work including: material handling (18.1 percent); production support work (16.2 percent); mine development (11.7 percent); and construction or reconstruction of mine facilities (11.7 percent).

Tables 34–39 present national estimates for safety, communication, and rescue measures. Mine page phones (83.8 percent) are the most frequently used communication system followed by dedicated telephones (62.6 percent), and hand-held two-way radios (56.1 percent). Tag boards (93.1 percent) and reflective vests/clothing (69.5 percent) are the most frequently used personal locators/trackers in underground mines. Colored reflectors (78.2 percent) and signage (75.1 percent) are the most frequently reported escape aids. First aid kits (88.9 percent), belt-worn self-contained self-rescuers (SCSRs) (74.6 percent), and cached water/food supplies (64.4 percent) are the top three emergency equipment and supplies found in these mines. Seventy-two percent of underground mines use pager phones for emergency early warnings. Approximately 40 percent of underground mines report having their own mine rescue team composed of 11 team members. The majority of mine rescue teams train once a month (64.6 percent).

Table 27. Miner Training Within the Past 12 Months at Underground Mines

Training Conducted by	Percentage of Mines	95% CI
Mine employees		
Annual miner refresher	75.2	(67.3, 83.1)
Newly hired inexperienced miner	69.8	(63.3, 76.4)
Newly hired experienced miner	83.1	(76.5, 89.6)
Outside trainer		
Annual miner refresher	58.5	(49.9, 67.1)
Newly hired inexperienced miner	37.3	(27.8, 46.7)
Newly hired experienced miner	18.5	(10.0, 27.0)
Outside contract trainer		
Annual miner refresher	73.9	(64.6, 83.1)
Newly hired inexperienced miner	68.5	(54.8, 82.2)
Newly hired experienced miner	83.2	(69.5, 96.8)
Outside state grantee		
Annual miner refresher	27.0	(17.6, 36.3)
Newly hired inexperienced miner	26.8	(14.7, 38.8)
Newly hired experienced miner	29.6	(13.3, 45.9)
Outside other trainer		
Annual miner refresher	11.9	(2.4, 21.5)
Newly hired inexperienced miner	11.4	(2.0, 20.8)
Newly hired experienced miner	DSU	DSU

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 28. Frequency of Periodic Safety Meetings at Underground Mines

Response	Percentage of Mines	95% CI
Less than once a year	0.0	NA
Annually	DSU	DSU
Less than once a month	DSU	DSU
Once a month	9.9	(5.6, 14.3)
Once every 2 weeks	DSU	DSU
Once a week	47.8	(38.3, 57.3)
Several times a week	14.6	(8.1, 21.0)
Daily	23.3	(14.8, 31.9)

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 29. Employee Safety Training Materials and Methods at Underground Mines

Response	Percentage of Mines	95% CI
Lectures	97.3	(94.7, 100.0)
Written materials	92.0	(87.5, 96.6)
Videos	84.9	(78.7, 91.1)
Self-guided interactive computer programs	10.4	(4.9, 15.9)
Demonstrations	85.4	(80.1, 90.6)
Hands-on training exercises	83.8	(77.2, 90.5)
Group exercises (role playing, games, problem solving)	54.7	(47.5, 61.9)
Classroom simulations (e.g., virtual reality)	21.3	(15.0, 27.5)
Worksite simulations	39.7	(32.7, 46.7)
Narrative storytelling	54.6	(47.0, 62.2)
Other	5.0	(0.9, 9.1)

Notes: Data are national estimates; multiple responses permitted.

Table 30. Non-English Languages at Underground Mines

Response	Percentage	95% CI
Employees use a language other than English to communicate	3.9	(0.6, 7.1)
Mining operations provide training materials, signs, or written materials, in language(s) other than English	9.9	(4.6, 15.2)
Language(s) provided[1]		
Spanish	90.1	(73.3, 100.0)
Other	DSU	DSU
Helpful to have training materials, signs, or written materials in other languages, in addition to those already provided	DSU	DSU
Helpful to have training materials, signs, or written materials in language(s) other than English	8.6	(4.2, 13.0)

[1]Multiple responses permitted. Abbreviation: DSU, data suppressed.

Note: Data are national estimates.

Table 31. Work Schedules at Underground Mines

Response	Production Workers	95% CI	Production Support Workers	95% CI	Preparation Plant/Mill Workers	95% CI
Scheduled days per week (average)	5.1	(5.0, 5.2)	5.1	(5.0, 5.3)	5.0	(4.8, 5.3)
Scheduled hours per day (average)	9.3	(9.2, 9.5)	9.2	(9.0, 9.4)	9.3	(8.9, 9.7)
Actual hours worked per week (average)	42.9	(40.3, 45.5)	41.8	(38.9, 44.6)	42.7	(38.9, 46.5)
Work crews change shifts at active mining site (percentage)	47.0	(38.4, 55.6)	26.6	(18.9, 34.3)	NA	NA
Average time spent traveling to and from active mining site while being paid (hours)	1.7	(1.5, 1.8)	1.7	(1.5, 1.8)	NA	NA

Abbreviation: NA, not applicable. Note: Data are national estimates.

Table 32. Shift Work Schedules at Underground Mines

Response	Production Workers Percentage of Mines	95% CI	Production Support Workers Percentage of Mines	95% CI	Preparation Plant/Mill Workers Percentage of Mines	95% CI
Number of shifts per day						
1 shift	31.9	(24.9, 38.9)	58.0	(49.9, 66.1)	33.1	(23.6, 42.7)
2 shifts	46.7	(38.4, 55.0)	16.3	(9.8, 22.9)	38.1	(26.8, 49.3)
3 shifts	20.3	(13.4, 27.1)	24.8	(17.2, 32.5)	27.1	(17.0, 37.3)
4 shifts	DSU	DSU	DSU	DSU	DSU	DSU
Rotating shifts	42.2	(35.4, 49.0)	20.1	(14.4, 25.9)	22.9	(14.3, 31.5)
Frequency workers rotate shifts						
Weekly	49.9	(34.6, 65.1)	40.0	(20.1, 60.0)	52.7	(28.8, 76.7)
Twice a month	45.0	(29.9, 60.1)	44.1	(22.1, 66.1)	41.7	(17.8, 65.6)
Monthly	0.0	NA	0.0	NA	DSU	DSU
Other	DSU	DSU	DSU	DSU	0.0	NA
Direction the shift rotates						
Clockwise (day—afternoon—night)	65.0	(50.6, 79.5)	56.2	(36.4, 76.1)	63.4	(39.3, 87.5)
Counterclockwise (night—afternoon—day)	7.0	(0.0, 14.6)	DSU	DSU	28.2	(4.8, 51.7)
Other	28.0	(15.3, 40.6)	27.6	(12.1, 43.1)	DSU	DSU
Unique work shifts	19.1	(12.1, 26.1)	12.5	(6.4, 18.5)	7.6	(0.7, 14.4)

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 33. Activities of Independent Contractor Employees During the Reporting Week at Underground Mines

Response	Percentage of Mines Reporting Contractors	95% CI	Average Number of Contractor Employees	95% CI	Average Total Hours	95% CI
Mine development	11.7	(5.8, 17.5)	14.0	(4.7, 23.4)	487.9	(83.2, 892.7)
Construction or reconstruction of mine facilities	11.7	(7.5, 16.0)	10.5	(0.0, 22.2)	184.4	(80.9, 288.0)
Demolition of mine facilities	0.0	NA	NA	NA	NA	NA
Construction of dams	DSU	DSU	DSU	DSU	DSU	DSU
Excavation or earthmoving activities (involving mobile equipment)	6.8	(2.7, 11.0)	8.0	(3.2, 12.7)	323.0	(110.1, 535.8)
Equipment installation	DSU	DSU	DSU	DSU	DSU	DSU
Equipment service or repair of equipment on mine property (exceeding 5 consecutive days)	8.0	(4.6, 11.4)	3.4	(1.8, 5.1)	115.5	(0.0, 247.3)
Material handling (within mine property)	18.1	(9.3, 26.8)	5.6	(3.1, 8.1)	211.9	(111.1, 312.7)
Drilling and blasting	4.9	(2.1, 7.7)	7.5	(0.8, 14.2)	282.8	(0.0, 579.3)
Production support work	16.2	(10.1, 22.3)	11.3	(6.4, 16.1)	432.7	(222.0, 643.4)
Mineral extraction	4.8	(1.1, 8.5)	11.9	(3.0, 20.7)	461.5	(98.1, 825.0)
Other work	5.5	(1.4, 9.5)	14.1	(0.9, 27.3)	620.2	(0.0, 1256.1)

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 34. Communication Devices and Systems at Underground Mines

Response	Percentage of Mines	95% CI
Dedicated telephones	62.6	(54.3, 71.0)
Mine page phones	83.8	(79.3, 88.4)
Trolley phones	DSU	DSU
Shaft or hoist phones	9.8	(5.9, 13.7)
Cell phones	40.1	(32.0, 48.2)
Voice over internet protocol (VOIP) phones	6.7	(2.9, 10.5)
Hand-held two-way radios	56.1	(46.9, 65.2)
Wireless paging devices	4.4	(0.4, 8.4)
Leaky feeder communications system (not running a PED)	23.3	(17.1, 29.6)
Personal emergency device (PED) cap lamp/pager	5.0	(2.0, 8.0)
Through-the-Earth (TTE) technology (other than a PED)	DSU	DSU
Inductive coupled radios	DSU	DSU
Ethernet	9.5	(4.6, 14.5)
TRACKER tagging system	6.4	(2.9, 9.8)
Longwall face communication systems	5.6	(2.2, 9.1)
None of the above	DSU	DSU
Other	7.7	(3.1, 12.4)

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 35. Personal Locators, Trackers, and Devices at Underground Mines

Response	Percentage of Mines	95% CI
Electronic or computerized tagging or tracking	6.6	(2.7, 10.6)
Tag boards	93.1	(88.1, 98.0)
Reflective vests/clothing	69.5	(61.7, 77.2)
Chemical light sticks	20.8	(13.7, 27.9)
Lighted vests	DSU	DSU
Laser lights/pointers	DSU	DSU
Strobe lights	23.4	(15.7, 31.2)
None of the above	DSU	DSU
Other	10.1	(4.2, 16.0)

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 36. Emergency Early Warning Methods at Underground Mines

Response	Percentage of Mines	95% CI
Stench gas	10.4	(6.7, 14.1)
Audible systems	65.0	(57.7, 72.4)
Visual systems	59.3	(51.8, 66.8)
Pager phones	72.2	(67.2, 77.1)
Telephones	42.7	(34.4, 50.9)
Messengers	18.5	(11.9, 25.2)
Electronic personal communication systems	6.4	(2.7, 10.1)
None of the above	DSU	DSU
Other	10.1	(5.4, 14.9)

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 37. Rescue Teams at Underground Mines

Response	Percentage of Mines	95% CI
Mine has own rescue team	39.5	(31.9, 47.0)
Average number of rescue team members	11.0	(8.8, 13.2)
Frequency of team training		
Less than once a year	0.0	NA
Annually	DSU	DSU
Less than once a month	8.0	(1.1, 15.0)
Once a month	64.6	(49.7, 79.4)
Once every 2 weeks	12.1	(1.9, 22.3)
Once a week	DSU	DSU
Other time interval	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 38. Emergency Equipment and Supplies at Underground Mines

Response	Percentage of Mines	95% CI
Belt-worn self-contained self-rescuers (SCSRs)	74.6	(68.8, 80.3)
Cached self-contained self-rescuers (SCSRs)	59.5	(53.9, 65.2)
Filter self-rescuers (FSRs)	26.6	(20.5, 32.7)
Stationary emergency refuge chambers	27.1	(20.2, 34.0)
Mobile emergency refuge chambers	11.4	(6.0, 16.9)
Sealing materials	57.0	(51.4, 62.6)
Cached water/food supplies	64.4	(58.5, 70.4)
First aid kits	88.9	(84.2, 93.6)
Defibrillator	45.0	(35.5, 54.6)
None of the above	DSU	DSU
Other	DSU	DSU

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 39. Escape Aids at Underground Mines

Response	Percentage of Mines	95% CI
Lifelines	46.5	(39.7, 53.2)
Directional lifelines	59.6	(55.2, 64.0)
Signage	75.1	(68.7, 81.5)
Colored reflectors	78.2	(73.5, 82.8)
Lighting	20.9	(14.1, 27.8)
Strobe lights	16.3	(10.3, 22.3)
None of the above	DSU	DSU
Other	DSU	DSU

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Mine Statistics for All Surface Mines

Summary of Mine Statistics for All Surface Mines

The data for training and non-English languages can be found in Tables 40–43. For all surface mines, the weighted survey estimates indicate that more training is conducted by the mine's employees including: annual refresher training (70.2 percent); newly hired inexperienced miner training (64.0 percent); and newly hired experienced miner training (59.2 percent) when compared to the mine's use of outside trainers. Lectures (87.0 percent), written materials (84.6 percent), and videos (78.6 percent) are the top three methods and materials used for training. Estimates from the survey indicate that 39.7 percent of surface mines have employee safety meetings once a week. Approximately eight percent of surface mine employees use a language other than English.

Tables 44 and 45 present the national estimates for work schedules and shift work. The average number of hours worked per week is 39.0 for production workers, 38.3 for production support workers, and 39.5 for preparation plant/mill workers. The majority of surface mines operate one shift per day (79.8 percent for production workers, 83.8 percent for production support workers, and 68.0 percent for preparation plant/mill workers).

National estimates for independent contractor employees are presented in Table 46. During a typical week, surface mines use independent contractor employees for various types of work including: drilling and blasting (11.5 percent); construction or reconstruction of mine facilities (8.8 percent); equipment service or repair of equipment on mine property (7.4 percent), and excavation or earthmoving activities (5.4 percent).

Tables 47–50 present national estimates for safety, communication, and rescue measures. Cell phones (91.3 percent) are the most frequently used communication system followed by hand-held two-way radios (62.5 percent), and dedicated telephones (38.9 percent). Forty-nine percent of surface mines use telephones for emergency early warnings. Approximately seven percent of surface mines report having their own mine rescue team composed of about seven team members. The majority of mine rescue teams train on an annual basis (70.3 percent).

Table 40. Miner Training Within the Past 12 Months at Surface Mines

Training Conducted by	Percentage of Mines	95% CI
Mine employees		
Annual miner refresher	70.2	(66.3, 74.2)
Newly hired inexperienced miner	64.0	(59.1, 68.8)
Newly hired experienced miner	59.2	(54.7, 63.8)
Outside trainer		
Annual miner refresher	58.5	(52.9, 64.1)
Newly hired inexperienced miner	18.5	(15.1, 21.9)
Newly hired experienced miner	15.3	(10.5, 20.2)
Outside contract trainer		
Annual miner refresher	49.7	(44.1, 55.4)
Newly hired inexperienced miner	56.8	(43.8, 69.8)
Newly hired experienced miner	64.2	(51.6, 76.7)
Outside state grantee		
Annual miner refresher	36.8	(28.1, 45.5)
Newly hired inexperienced miner	39.6	(22.8, 56.5)
Newly hired experienced miner	29.1	(10.1, 48.2)
Outside other trainer		
Annual miner refresher	17.5	(12.6, 22.4)
Newly hired inexperienced miner	8.1	(4.3, 11.8)
Newly hired experienced miner	13.0	(3.5, 22.6)

Notes: Data are national estimates; multiple responses permitted.

Table 41. Frequency of Periodic Safety Meetings at Surface Mines

Response	Percentage of Mines	95% CI
Less than once a year	2.0	(1.0, 3.1)
Annually	5.3	(3.0, 7.6)
Less than once a month	9.3	(6.6, 12.0)
Once a month	21.9	(17.5, 26.4)
Once every 2 weeks	6.9	(4.0, 9.8)
Once a week	39.7	(32.8, 46.6)
Several times a week	6.3	(4.1, 8.5)
Daily	8.6	(4.9, 12.4)

Note: Data are national estimates.

Table 42. Employee Safety Training Materials and Methods at Surface Mines

Response	Percentage of Mines	95% CI
Lectures	87.0	(84.0, 90.1)
Written materials	84.6	(80.5, 88.7)
Videos	78.6	(75.4, 81.8)
Self-guided interactive computer programs	17.7	(12.7, 22.7)
Demonstrations	61.5	(54.9, 68.0)
Hands-on training exercises	64.6	(59.6, 69.5)
Group exercises (role playing, games, problem solving)	32.1	(28.4, 35.8)
Classroom simulations (e.g., virtual reality)	11.4	(8.8, 14.0)
Worksite simulations	31.8	(27.0, 36.6)
Narrative storytelling	46.0	(40.6, 51.4)
Other	3.1	(1.6, 4.6)

Notes: Data are national estimates; multiple responses permitted.

Table 43. Non-English Languages at Surface Mines

Response	Percentage	95% CI
Employees use a language other than English to communicate	7.5	(4.8, 10.2)
Mining operations provide training materials, signs, or written materials in language(s) other than English	20.9	(16.0, 25.8)
Language(s) provided[1]		
Spanish	100.0	NA
Other	DSU	DSU
Helpful to have training materials, signs, or written materials in other languages, in addition to those already provided	33.0	(19.2, 46.7)
Helpful to have training materials, signs, or written materials in language(s) other than English	9.9	(7.1, 12.7)

[1]Multiple responses permitted. Abbreviations: DSU, data suppressed; NA, not applicable.

Note: Data are national estimates.

Table 44. Work Schedules at Surface Mines

Response	Production Workers	95% CI	Production Support Workers	95% CI	Preparation Plant/Mill Workers	95% CI
Scheduled days per week (average)	4.8	(4.7, 4.9)	4.9	(4.8, 4.9)	4.9	(4.8, 5.0)
Scheduled hours per day (average)	9.1	(8.9, 9.3)	9.7	(8.7, 10.8)	9.1	(8.7, 9.5)
Actual hours worked per week (average)	39.0	(37.2, 40.7)	38.3	(36.4, 40.3)	39.5	(35.5, 43.6)
Work crews change shifts at active mining site (percentage)	9.8	(7.6, 12.1)	9.9	(6.6, 13.2)	NA	NA
Average time spent traveling to and from active mining site while being paid (hours)	1.6	(1.5, 1.7)	1.6	(1.5, 1.7)	NA	NA

Abbreviation: NA, not applicable. Note: Data are national estimates.

Table 45. Shift Work Schedules at Surface Mines

Response	Production Workers Percentage of Mines	95% CI	Production Support Workers Percentage of Mines	95% CI	Preparation Plant/Mill Workers Percentage of Mines	95% CI
Number of shifts per day						
1 shift	79.8	(76.2, 83.3)	83.8	(79.5, 88.1)	68.0	(60.3, 75.6)
2 shifts	16.9	(13.5, 20.4)	13.1	(9.2, 16.9)	22.0	(15.1, 28.8)
3 shifts	1.7	(0.8, 2.6)	3.0	(1.7, 4.4)	9.1	(6.4, 11.7)
4 shifts	1.6	(1.3, 1.9)	DSU	DSU	DSU	DSU
Rotating shifts	5.5	(3.4, 7.6)	4.8	(2.9, 6.7)	10.7	(7.1, 14.4)
Frequency workers rotate shifts						
Weekly	68.4	(51.7, 85.1)	65.4	(47.7, 83.1)	50.7	(33.5, 67.8)
Twice a month	8.7	(3.3, 14.1)	10.9	(3.9, 17.9)	13.4	(5.2, 21.6)
Monthly	DSU	DSU	DSU	DSU	17.5	(0.9, 34.1)
Other	5.7	(1.5, 10.0)	7.2	(2.2, 12.2)	18.4	(3.1, 33.8)
Direction the shift rotates						
Clockwise (day—afternoon—night)	80.4	(70.8, 90.1)	72.4	(59.1, 85.7)	67.5	(52.5, 82.6)
Counterclockwise (night—afternoon—day)	6.1	(1.5, 10.8)	12.0	(4.2, 19.7)	8.5	(2.4, 14.6)
Other	13.4	(5.5, 21.4)	15.6	(4.4, 26.8)	24.0	(9.0, 39.0)
Unique work shifts	3.0	(1.4, 4.6)	2.6	(1.0, 4.3)	4.4	(2.0, 6.9)

Abbreviation: DSU, data suppressed. Note: Data are national estimates.

Table 46. Activities of Independent Contractor Employees During the Reporting Week at Surface Mines

Response	Percentage of Mines Reporting Contractors	95% CI	Average Number of Contractor Employees	95% CI	Average Total Hours	95% CI
Mine development	1.5	(0.4, 2.6)	6.2	(2.8, 9.5)	98.7	(31.5, 165.8)
Construction or reconstruction of mine facilities	8.8	(6.0, 11.5)	10.9	(5.1, 16.7)	307.3	(104.3, 510.3)
Demolition of mine facilities	0.2	(0.0, 0.4)	50.4	(0.0, 148.0)	DSU	DSU
Construction of dams	DSU	DSU	DSU	DSU	DSU	DSU
Excavation or earthmoving activities (involving mobile equipment)	5.4	(3.5, 7.4)	6.9	(4.1, 9.7)	228.1	(121.5, 334.7)
Equipment installation	2.5	(1.1, 3.9)	7.2	(0.0, 15.1)	314.0	(0.0, 708.8)
Equipment service or repair of equipment on mine property (exceeding 5 consecutive days)	7.4	(5.2, 9.6)	5.1	(0.7, 9.5)	122.1	(49.0, 195.2)
Material handling (within mine property)	5.1	(3.4, 6.9)	8.5	(5.4, 11.6)	214.9	(122.8, 307.0)
Drilling and blasting	11.5	(9.0, 14.0)	2.9	(2.2, 3.7)	61.0	(29.9, 92.1)
Production support work	1.4	(0.5, 2.3)	8.3	(2.4, 14.2)	323.3	(14.7, 631.8)
Mineral extraction	1.0	(0.3, 1.8)	2.8	(0.8, 4.9)	97.5	(3.8, 191.2)
Other work	1.0	(0.2, 1.7)	8.3	(0.7, 15.9)	191.4	(0.0, 449.5)

Abbreviation: DSU, data suppressed. Note: Data are national estimates.

Table 47. Communication Devices and Systems at Surface Mines

Response	Percentage of Mines	95% CI
Dedicated telephones	38.9	(33.1, 44.6)
Mine page phones	4.3	(2.5, 6.0)
Trolley phones	0.0	NA
Shaft or hoist phones	NA	NA
Cell phones	91.3	(88.4, 94.3)
Voice over internet protocol (VOIP) phones	0.6	(0.1, 1.2)
Hand-held two-way radios	62.5	(57.1, 67.8)
Wireless paging devices	4.6	(2.6, 6.6)
Leaky feeder communications system (not running a PED)	0.3	(0.0, 0.7)
Personal emergency device (PED) cap lamp/pager	DSU	DSU
Through-the-Earth (TTE) technology (other than a PED)	DSU	DSU
Inductive coupled radios	2.2	(1.1, 3.2)
Ethernet	3.6	(2.1, 5.0)
TRACKER tagging system	DSU	DSU
Longwall face communication systems	NA	NA
None of the above	1.5	(0.6, 2.3)
Other	19.8	(14.6, 25.0)

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 48. Personal Locators, Trackers, and Devices at Surface Mines

Response	Percentage of Mines	95% CI
Electronic or computerized tagging or tracking	0.4	(0.0, 0.7)
Tag boards	3.0	(1.8, 4.2)
Reflective vests/clothing	34.3	(27.1, 41.5)
Chemical light sticks	1.5	(0.3, 2.7)
Lighted vests	1.8	(1.0, 2.6)
Laser lights/pointers	DSU	DSU
Strobe lights	10.2	(6.4, 13.9)
None of the above	59.7	(52.2, 67.2)
Other	4.6	(2.5, 6.7)

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 49. Emergency Early Warning Methods at Surface Mines

Response	Percentage of Mines	95% CI
Stench gas	DSU	DSU
Audible systems	29.1	(25.4, 32.7)
Visual systems	12.7	(8.8, 16.5)
Pager phones	4.4	(2.5, 6.3)
Telephones	48.7	(44.4, 53.0)
Messengers	13.6	(7.6, 19.7)
Electronic personal communication systems	1.9	(0.4, 3.4)
None of the above	28.0	(21.9, 34.2)
Other	16.6	(12.3, 21.0)

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 50. Rescue Teams at Surface Mines

Response	Percentage of Mines	95% CI
Mine has own rescue team	6.5	(3.3, 9.7)
Average number of rescue team members	6.7	(5.0, 8.4)
Frequency of team training		
Less than once a year	DSU	DSU
Annually	70.3	(45.5, 95.0)
Less than once a month	0.9	(0.0, 2.1)
Once a month	DSU	DSU
Once every 2 weeks	DSU	DSU
Once a week	DSU	DSU
Other time interval	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable.

Note: Data are national estimates.

Mine Statistics for Coal Mines

Summary of Mine Statistics for Coal Mines

The data for training and non-English languages can be found in Tables 51–54. For the U.S. coal mining industry, the weighted survey estimates indicate that annual miner refresher training is conducted slightly more often by an outside trainer (68.8 percent) compared to the mine's own employees (67.6 percent). However, newly hired inexperienced and experienced miner training is more often conducted by the mines own employees (58.1 percent and 74.8 percent, respectively). Lectures (98.0 percent), written materials (89.5 percent), and videos (87.9 percent) are the top three methods and materials used for training. Estimates from the survey indicate that 51.7 percent of all coal mines have employee safety meetings once a week. Only two percent of coal mine employees use a language other than English.

Tables 55 and 56 present the national estimates for work schedules and shift work. The average number of hours worked per week is 46.9 for production workers, 44.3 for production support workers, and 45.6 for preparation plant/mill workers. The majority of coal mines operate two shifts per day for production workers (56.1 percent) and preparation plant/mill workers (48.8 percent) and one shift per day for production support workers (51.4 percent).

National estimates for independent contractor employees are presented in Table 57. During a typical week, coal mines use independent contractor employees for various types of work including: material handling (29.5 percent); construction or reconstruction of mine facilities (18.4 percent); drilling and blasting (16.1 percent); and equipment service or repair of equipment on mine property (14.1 percent).

Tables 58–61 present national estimates for safety, communication, and rescue measures. Cell phones (73.6 percent) are the most frequently used communication system followed by hand-held two-way radios (59.2 percent), and dedicated telephones (52.4 percent). Reflective vests/clothing (51.8 percent) and tag boards (31.2 percent) are the most frequently used personal locators/trackers in coal mines. Fifty-six percent of coal mines use telephones for emergency early warnings. Nineteen percent of these mines report having their own mine rescue team composed of approximately 10 team members. The majority of mine rescue teams train once a month (69.8 percent).

Table 51. Miner Training Within the Past 12 Months at Coal Mines

Training Conducted by	Percentage of Mines	95% CI
Mine employees		
Annual miner refresher	67.6	(60.0, 75.1)
Newly hired inexperienced miner	58.1	(49.6, 66.7)
Newly hired experienced miner	74.8	(62.6, 87.1)
Outside trainer		
Annual miner refresher	68.8	(61.1, 76.5)
Newly hired inexperienced miner	34.2	(25.7, 42.8)
Newly hired experienced miner	27.8	(15.4, 40.2)
Outside contract trainer		
Annual miner refresher	74.2	(66.1, 82.3)
Newly hired inexperienced miner	73.7	(59.3, 88.2)
Newly hired experienced miner	84.9	(69.6, 100.0)
Outside state grantee		
Annual miner refresher	22.1	(14.2, 30.0)
Newly hired inexperienced miner	26.1	(14.5, 37.6)
Newly hired experienced miner	8.1	(1.0, 15.3)
Outside other trainer		
Annual miner refresher	13.1	(7.9, 18.2)
Newly hired inexperienced miner	9.0	(1.8, 16.1)
Newly hired experienced miner	DSU	DSU

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 52. Frequency of Periodic Safety Meetings at Coal Mines

Response	Percentage of Mines	95% CI
Less than once a year	DSU	DSU
Annually	DSU	DSU
Less than once a month	5.6	(0.4, 10.8)
Once a month	10.6	(5.1, 16.1)
Once every 2 weeks	5.1	(0.0, 10.6)
Once a week	51.7	(42.6, 60.8)
Several times a week	12.4	(5.1, 19.7)
Daily	12.2	(6.0, 18.3)

Abbreviation: DSU, data suppressed. Note: Data are national estimates.

Table 53. Employee Safety Training Materials and Methods at Coal Mines

Response	Percentage of Mines	95% CI
Lectures	98.0	(95.9, 100.0)
Written materials	89.5	(83.7, 95.4)
Videos	87.9	(80.6, 95.2)
Self-guided interactive computer programs	6.1	(2.5, 9.7)
Demonstrations	77.6	(67.4, 87.7)
Hands-on training exercises	78.4	(67.9, 88.9)
Group exercises (role playing, games, problem solving)	53.3	(44.3, 62.3)
Classroom simulations (e.g., virtual reality)	22.6	(15.2, 30.0)
Worksite simulations	36.5	(26.7, 46.4)
Narrative storytelling	47.0	(35.3, 58.7)
Other	5.0	(1.2, 8.9)

Notes: Data are national estimates; multiple responses permitted.

Table 54. Non-English Languages at Coal Mines

Response	Percentage	95% CI
Employees use a language other than English to communicate	2.0	(0.0, 4.5)
Mining operations provide training materials, signs, or written materials, in language(s) other than English	7.0	(0.8, 13.2)
Language(s) provided[1]		
Spanish	93.8	(82.1, 100.0)
Other	DSU	DSU
Helpful to have training materials, signs, or written material in additional language(s) than those language(s) already provided	DSU	DSU
Helpful to have training materials, signs, or written materials in languages(s) other than English	3.2	(0.8, 5.6)

[1]Multiple responses permitted. Abbreviation: DSU, data suppressed.

Note: Data are national estimates.

Table 55. Work Schedules at Coal Mines

Response	Production Workers	95% CI	Production Support Workers	95% CI	Preparation Plant/Mill Workers	95% CI
Scheduled days per week (average)	5.4	(5.3, 5.6)	5.3	(5.2, 5.5)	5.1	(4.9, 5.3)
Scheduled hours per day (average)	9.5	(9.0, 9.9)	9.3	(8.9, 9.8)	9.7	(9.3, 10.1)
Actual hours worked per week (average)	46.9	(44.1, 49.7)	44.3	(40.6, 47.9)	45.6	(35.1, 56.0)
Work crews change shifts at active mining site (percentage)	39.4	(29.9, 49.0)	24.4	(17.1, 31.6)	NA	NA
Average time spent traveling to and from active mining site while being paid (hours)	1.7	(1.6, 1.8)	1.7	(1.5, 1.8)	NA	NA

Abbreviation: NA, not applicable. Note: Data are national estimates.

Table 56. Shift Work Schedules at Coal Mines

Response	Production Workers Percentage of Mines	95% CI	Production Support Workers Percentage of Mines	95% CI	Preparation Plant/Mill Workers Percentage of Mines	95% CI
Number of shifts per day						
1 shift	30.6	(22.6, 38.6)	51.4	(41.6, 61.3)	24.8	(7.1, 42.6)
2 shifts	56.1	(47.7, 64.5)	29.6	(20.7, 38.5)	48.8	(31.4, 66.1)
3 shifts	12.2	(7.2, 17.2)	17.7	(11.1, 24.3)	25.3	(15.4, 35.2)
4 shifts	DSU	DSU	DSU	DSU	DSU	DSU
Rotating shifts	31.2	(23.6, 38.8)	19.0	(12.2, 25.7)	22.3	(11.9, 32.7)
Frequency workers rotate shifts						
Weekly	63.3	(50.7, 76.0)	66.1	(50.2, 82.1)	49.2	(17.4, 81.0)
Twice a month	31.8	(19.6, 43.9)	20.3	(6.2, 34.3)	21.3	(2.1, 40.5)
Monthly	0.0	NA	0.0	NA	DSU	DSU
Other	DSU	DSU	13.6	(1.9, 25.3)	DSU	DSU
Direction the shift rotates						
Clockwise (day—afternoon—night)	67.4	(53.4, 81.4)	65.3	(45.3, 85.3)	60.5	(24.8, 96.3)
Counterclockwise (night—afternoon—day)	DSU	DSU	DSU	DSU	DSU	DSU
Other	27.0	(13.8, 40.3)	25.6	(6.2, 45.0)	DSU	DSU
Unique work shifts	17.8	(10.4, 25.2)	12.8	(6.2, 19.4)	10.7	(4.5, 16.9)

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 57. Activities of Independent Contractor Employees During the Reporting Week at Coal Mines

Response	Percentage of Mines Reporting Contractors	95% CI	Average Number of Contractor Employees	95% CI	Average Total Hours	95% CI
Mine development	7.1	(2.7, 11.4)	10.7	(7.4, 14.1)	212.5	(87.8, 337.2)
Construction or reconstruction of mine facilities	18.4	(12.8, 23.9)	14.7	(0.8, 28.5)	545.3	(0.0, 1105.6)
Demolition of mine facilities	0.0	NA	NA	NA	NA	NA
Construction of dams	DSU	DSU	DSU	DSU	DSU	DSU
Excavation or earthmoving activities (involving mobile equipment)	9.3	(4.7, 13.9)	11.5	(6.8, 16.2)	430.8	(172.9, 688.6)
Equipment installation	DSU	DSU	DSU	DSU	DSU	DSU
Equipment service or repair of equipment on mine property (exceeding 5 consecutive days)	14.1	(7.3, 20.9)	4.0	(2.6, 5.4)	153.1	(88.2, 218.0)
Material handling (within mine property)	29.5	(21.5, 37.4)	8.7	(5.5, 11.9)	225.9	(134.4, 317.4)
Drilling and blasting	16.1	(10.3, 21.8)	2.7	(1.8, 3.7)	80.8	(32.3, 129.2)
Production support work	8.8	(4.4, 13.1)	12.9	(6.3, 19.6)	539.3	(206.3, 872.3)
Mineral extraction	DSU	DSU	DSU	DSU	DSU	DSU
Other work	4.7	(0.2, 9.1)	7.2	(0.0, 18.9)	282.3	(0.0, 824.4)

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 58. Communication Devices and Systems at Coal Mines

Response	Percentage of Mines	95% CI
Dedicated telephones	52.4	(43.2, 61.7)
Mine page phones	42.5	(35.6, 49.4)
Trolley phones	DSU	DSU
Shaft or hoist phones	3.4	(0.9, 6.0)
Cell phones	73.6	(66.0, 81.3)
Voice over internet protocol (VOIP) phones	1.8	(0.2, 3.5)
Hand-held two-way radios	59.2	(47.8, 70.5)
Wireless paging devices	9.2	(3.1, 15.2)
Leaky feeder communications system (not running a PED)	7.7	(3.8, 11.5)
Personal emergency device (PED) cap lamp/pager	1.7	(0.5, 3.0)
Through-the-Earth (TTE) technology (other than a PED)	DSU	DSU
Inductive coupled radios	DSU	DSU
Ethernet	11.3	(7.0, 15.6)
TRACKER tagging system	2.5	(0.8, 4.1)
Longwall face communication systems	2.9	(1.2, 4.6)
None of the above	DSU	DSU
Other	17.8	(9.4, 26.2)

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 59. Personal Locators, Trackers, and Devices at Coal Mines

Response	Percentage of Mines	95% CI
Electronic or computerized tagging or tracking	2.9	(1.1, 4.7)
Tag boards	31.2	(27.1, 35.3)
Reflective vests/clothing	51.8	(41.8, 61.8)
Chemical light sticks	13.8	(8.6, 19.0)
Lighted vests	0.0	NA
Laser lights/pointers	DSU	DSU
Strobe lights	22.9	(14.2, 31.6)
None of the above	32.1	(22.4, 41.9)
Other	6.3	(2.1, 10.4)

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 60. Emergency Early Warning Methods at Coal Mines

Response	Percentage of Mines	95% CI
Stench gas	DSU	DSU
Audible systems	47.4	(39.8, 55.1)
Visual systems	31.4	(23.1, 39.8)
Pager phones	39.6	(32.1, 47.1)
Telephones	55.8	(46.5, 65.1)
Messengers	10.6	(5.2, 16.0)
Electronic personal communication systems	3.4	(1.0, 5.7)
None of the above	20.5	(13.6, 27.5)
Other	7.0	(2.4, 11.6)

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 61. Rescue Teams at Coal Mines

Response	Percentage of Mines	95% CI
Mine has own rescue team	19.2	(13.9, 24.4)
Average number of rescue team members	10.2	(8.3, 12.2)
Frequency of team training		
Less than once a year	0.0	NA
Annually	DSU	DSU
Less than once a month	DSU	DSU
Once a month	69.8	(53.7, 85.9)
Once every 2 weeks	DSU	DSU
Once a week	DSU	DSU
Other time interval	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Mine Statistics for Underground Coal Mines

Summary of Mine Statistics for Underground Coal Mines

The data for training and non-English languages can be found in Tables 62–65. For underground coal mines, the weighted survey estimates indicate that more training is conducted by the mine's employees including: annual refresher training (71.5 percent); newly hired inexperienced miner training (65.1 percent); and newly hired experienced miner training (85.9 percent) when compared to the mine's use of outside trainers. Lectures (97.5 percent), written materials (92.8 percent), and videos (89.4 percent) are the top three methods and materials used for training. Estimates from the survey indicate that 52.9 percent of underground coal mines have employee safety meetings once a week. Approximately three percent of underground coal mine employees use a language other than English.

Tables 66 and 67 present the national estimates for work schedules and shift work. The average number of hours worked per week is 43.5 for production workers, 41.9 for production support workers, and 42.1 for preparation plant/mill workers. The majority of underground coal mines operate two shifts per day for production workers (49.8 percent) and preparation plant/mill workers (44.1 percent) and one shift per day for production support workers (51.4 percent).

National estimates for independent contractor employees are presented in Table 68. During a typical week, underground coal mines use independent contractor employees for various types of work including: material handling (22.6 percent); production support work (21.1 percent); mine development (14.0 percent); and construction or reconstruction of mine facilities (10.9 percent).

Tables 69–74 present national estimates for safety, communication, and rescue measures. Mine page phones (95.7 percent) are the most frequently used communication system followed by dedicated telephones (62.7 percent), and hand-held two-way radios (48.5 percent). Tag boards (90.9 percent) and reflective vests/clothing (75.2 percent) are the most frequently used personal locators/trackers in underground coal mines. Colored reflectors (87.9 percent) and directional lifelines (87.5 percent) are the most frequently reported escape aids. First aid kits (89.4 percent), belt-worn self-contained self-rescuers (SCSRs) (87.4 percent), and cached self-contained self-rescuers (84.6 percent) are the top three emergency equipment and supplies found in these mines. Eighty-seven percent of underground coal mines use pager phones for emergency early warnings. Approximately 41 percent of underground coal mines report having their own mine rescue team composed of 9 team members. The majority of mine rescue teams train once a month (65.6 percent).

Table 62. Miner Training Within the Past 12 Months at Underground Coal Mines

Training Conducted by	Percentage of Mines	95% CI
Mine employees		
Annual miner refresher	71.5	(60.4, 82.6)
Newly hired inexperienced miner	65.1	(55.9, 74.4)
Newly hired experienced miner	85.9	(77.1, 94.6)
Outside trainer		
Annual miner refresher	65.6	(54.4, 76.9)
Newly hired inexperienced miner	40.3	(28.0, 52.6)
Newly hired experienced miner	17.1	(5.5, 28.7)
Outside contract trainer		
Annual miner refresher	78.8	(68.3, 89.4)
Newly hired inexperienced miner	67.4	(49.9, 85.0)
Newly hired experienced miner	91.5	(73.9, 100.0)
Outside state grantee		
Annual miner refresher	24.2	(12.4, 35.9)
Newly hired inexperienced miner	28.1	(11.5, 44.8)
Newly hired experienced miner	DSU	DSU
Outside other trainer		
Annual miner refresher	DSU	DSU
Newly hired inexperienced miner	DSU	DSU
Newly hired experienced miner	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 63. Frequency of Periodic Safety Meetings at Underground Coal Mines

Response	Percentage of Mines	95% CI
Less than once a year	0.0	NA
Annually	0.0	NA
Less than once a month	0.0	NA
Once a month	DSU	DSU
Once every 2 weeks	DSU	DSU
Once a week	52.9	(40.3, 65.6)
Several times a week	17.9	(8.9, 26.9)
Daily	22.2	(10.1, 34.3)

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 64. Employee Safety Training Materials and Methods at Underground Coal Mines

Response	Percentage of Mines	95% CI
Lectures	97.5	(93.9, 100.0)
Written materials	92.8	(86.9, 98.7)
Videos	89.4	(82.2, 96.6)
Self-guided interactive computer programs	9.8	(2.4, 17.2)
Demonstrations	87.2	(81.1, 93.2)
Hands-on training exercises	89.1	(81.4, 96.7)
Group exercises (role playing, games, problem solving)	64.5	(56.1, 72.9)
Classroom simulations (e.g., virtual reality)	22.0	(13.6, 30.4)
Worksite simulations	41.0	(31.2, 50.7)
Narrative storytelling	54.0	(42.8, 65.1)
Other	DSU	DSU

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 65. Non-English Languages at Underground Coal Mines

Response	Percentage	95% CI
Employees use a language other than English to communicate	2.5	(0.0, 6.6)
Mining operations provide training materials, signs, or written materials, in language(s) other than English	DSU	DSU
Language(s) provided[1]		
Spanish	DSU	DSU
Other	DSU	DSU
Helpful to have training materials, signs, or written materials in other languages, in addition to those already provided	0.0	NA
Helpful to have training materials, signs, or written materials in language(s) other than English	5.8	(0.7, 10.9)

[1]Multiple responses permitted. Abbreviations: DSU, data suppressed; NA, not applicable.

Note: Data are national estimates.

Table 66. Work Schedules at Underground Coal Mines

Response	Production Workers	95% CI	Production Support Workers	95% CI	Preparation Plant/Mill Workers	95% CI
Scheduled days per week (average)	5.2	(5.0, 5.4)	5.2	(5.0, 5.4)	5.1	(4.7, 5.5)
Scheduled hours per day (average)	9.2	(9.0, 9.4)	9.1	(8.8, 9.4)	9.0	(8.3, 9.7)
Actual hours worked per week (average)	43.5	(39.9, 47.0)	41.9	(37.9, 45.9)	42.1	(36.0, 48.2)
Work crews change shifts at active mining site (percentage)	61.7	(49.7, 73.7)	36.9	(25.6, 48.2)	NA	NA
Average time spent traveling to and from active mining site while being paid (hours)	1.6	(1.5, 1.8)	1.6	(1.5, 1.8)	NA	NA

Abbreviation: NA, not applicable. Note: Data are national estimates.

Table 67. Shift Work Schedules at Underground Coal Mines

Response	Production Workers		Production Support Workers		Preparation Plant/Mill Workers	
	Percentage of Mines	95% CI	Percentage of Mines	95% CI	Percentage of Mines	95% CI
Number of shifts per day						
1 shift	22.5	(13.0, 31.9)	51.4	(40.0, 62.7)	14.4	(0.0, 30.5)
2 shifts	49.8	(37.8, 61.7)	13.3	(4.4, 22.2)	44.1	(24.0, 64.3)
3 shifts	26.0	(16.5, 35.6)	34.1	(23.1, 45.0)	38.1	(20.8, 55.4)
4 shifts	DSU	DSU	DSU	DSU	DSU	DSU
Rotating shifts	46.3	(36.9, 55.7)	20.1	(11.9, 28.3)	21.0	(6.3, 35.7)
Frequency workers rotate shifts						
Weekly	46.5	(27.8, 65.2)	33.7	(8.5, 58.9)	DSU	DSU
Twice a month	50.8	(32.1, 69.5)	47.0	(18.3, 75.7)	DSU	DSU
Monthly	0.0	NA	0.0	NA	0.0	NA
Other	DSU	DSU	DSU	DSU	0.0	NA
Direction the shift rotates						
Clockwise (day—afternoon—night)	66.1	(48.9, 83.3)	61.1	(36.6, 85.5)	DSU	DSU
Counterclockwise (night—afternoon—day)	DSU	DSU	DSU	DSU	DSU	DSU
Other	28.5	(12.1, 44.9)	DSU	DSU	0.0	NA
Unique work shifts	23.5	(13.8, 33.3)	13.3	(5.0, 21.6)	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 68. Activities of Independent Contractor Employees During the Reporting Week at Underground Coal Mines

Response	Percentage of Mines Reporting Contractors	95% CI	Average Number of Contractor Employees	95% CI	Average Total Hours	95% CI
Mine development	14.0	(5.5, 22.4)	7.9	(4.1, 11.7)	200.7	(159.4, 242.1)
Construction or reconstruction of mine facilities	10.9	(5.1, 16.6)	4.2	(2.9, 5.6)	104.0	(18.3, 190.3)
Demolition of mine facilities	0.0	NA	NA	NA	NA	NA
Construction of dams	0.0	NA	NA	NA	NA	NA
Excavation or earthmoving activities (involving mobile equipment)	5.2	(0.6, 9.8)	3.5	(2.1, 4.8)	88.4	(57.3, 119.4)
Equipment installation	0.0	NA	NA	NA	NA	NA
Equipment service or repair of equipment on mine property (exceeding 5 consecutive days)	DSU	DSU	DSU	DSU	DSU	DSU
Material handling (within mine property)	22.6	(10.4, 34.8)	6.1	(3.2, 9.0)	237.1	(120.4, 353.7)
Drilling and blasting	0.0	NA	NA	NA	NA	NA
Production support work	21.1	(11.8, 30.4)	12.2	(6.1, 18.2)	462.1	(210.9, 713.2)
Mineral extraction	DSU	DSU	DSU	DSU	DSU	DSU
Other work	DSU	DSU	DSU	DSU	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 69. Communication Devices and Systems at Underground Coal Mines

Response	Percentage of Mines	95% CI
Dedicated telephones	62.7	(50.8, 74.7)
Mine page phones	95.7	(90.6, 100.0)
Trolley phones	DSU	DSU
Shaft or hoist phones	6.1	(2.0, 10.2)
Cell phones	32.9	(22.2, 43.6)
Voice over internet protocol (VOIP) phones	6.3	(0.8, 11.7)
Hand-held two-way radios	48.5	(35.8, 61.2)
Wireless paging devices	DSU	DSU
Leaky feeder communications system (not running a PED)	17.5	(10.3, 24.8)
Personal emergency device (PED) cap lamp/pager	5.9	(1.7, 10.1)
Through-the-Earth (TTE) technology (other than a PED)	DSU	DSU
Inductive coupled radios	0.0	NA
Ethernet	11.6	(4.7, 18.5)
TRACKER tagging system	8.3	(2.9, 13.8)
Longwall face communication systems	8.3	(3.2, 13.5)
None of the above	DSU	DSU
Other	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 70. Personal Locators, Trackers, and Devices at Underground Coal Mines

Response	Percentage of Mines	95% CI
Electronic or computerized tagging or tracking	9.4	(3.6, 15.2)
Tag boards	90.9	(83.7, 98.2)
Reflective vests/clothing	75.2	(64.9, 85.4)
Chemical light sticks	30.1	(19.3, 40.8)
Lighted vests	0.0	NA
Laser lights/pointers	DSU	DSU
Strobe lights	20.7	(10.8, 30.6)
None of the above	DSU	DSU
Other	13.8	(5.3, 22.3)

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 71. Emergency Early Warning Methods at Underground Coal Mines

Response	Percentage of Mines	95% CI
Stench gas	DSU	DSU
Audible systems	74.3	(64.8, 83.9)
Visual systems	61.8	(51.4, 72.2)
Pager phones	87.0	(80.6, 93.5)
Telephones	44.9	(34.3, 55.6)
Messengers	13.5	(5.8, 21.1)
Electronic personal communication systems	8.1	(2.9, 13.3)
None of the above	DSU	DSU
Other	DSU	DSU

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 72. Rescue Teams at Underground Coal Mines

Response	Percentage of Mines	95% CI
Mine has own rescue team	40.9	(29.7, 52.0)
Average number of rescue team members	8.8	(6.7, 11.0)
Frequency of team training		
Less than once a year	0.0	NA
Annually	0.0	NA
Less than once a month	DSU	DSU
Once a month	65.6	(46.6, 84.5)
Once every 2 weeks	DSU	DSU
Once a week	DSU	DSU
Other time interval	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 73. Emergency Equipment and Supplies at Underground Coal Mines

Response	Percentage of Mines	95% CI
Belt-worn self-contained self-rescuers (SCSRs)	87.4	(80.3, 94.5)
Cached self-contained self-rescuers (SCSRs)	84.6	(77.1, 92.0)
Filter self-rescuers (FSRs)	13.6	(6.0, 21.3)
Stationary emergency refuge chambers	28.3	(18.9, 37.7)
Mobile emergency refuge chambers	13.8	(6.2, 21.3)
Sealing materials	76.3	(69.0, 83.6)
Cached water/food supplies	83.4	(76.5, 90.3)
First aid kits	89.4	(82.9, 95.9)
Defibrillator	44.1	(31.2, 57.0)
None of the above	DSU	DSU
Other	DSU	DSU

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted; data were collected prior to the effective date (March 2, 2009) of the Mine Safety and Health Administration's (MSHA) final rule for refuge alternatives in underground coal mines.

Table 74. Escape Aids at Underground Coal Mines

Response	Percentage of Mines	95% CI
Lifelines	66.0	(57.3, 74.7)
Directional lifelines	87.5	(82.0, 93.1)
Signage	70.6	(62.2, 78.9)
Colored reflectors	87.9	(82.8, 92.9)
Lighting	16.9	(9.3, 24.6)
Strobe lights	18.3	(9.8, 26.8)
None of the above	DSU	DSU
Other	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Mine Statistics for Surface Coal Mines

Summary of Mine Statistics for Surface Coal Mines

The data for training and non-English languages can be found in Tables 75–78. For surface coal mines, the weighted survey estimates indicate that annual miner refresher training is conducted more often by an outside trainer (70.1 percent) compared to the mine's own employees (65.9 percent). However, newly hired inexperienced and experienced miner training is more often conducted by the mine's own employees (55.2 percent and 70.1 percent, respectively). Lectures (98.2 percent), written materials (88.1 percent), and videos (87.2 percent) are the top three methods and materials used for training. Estimates from the survey indicate that 51.1 percent of surface coal mines have employee safety meetings once a week. Approximately two percent of surface coal mine employees use a language other than English.

Tables 79 and 80 present the national estimates for work schedules and shift work. The average number of hours worked per week is 49.2 for production workers, 45.9 for production support workers, and 46.4 for preparation plant/mill workers. The majority of surface coal mines operate two shifts per day for production workers (60.5 percent) and preparation plant/mill workers (49.9 percent) and one shift per day for production support workers (51.5 percent).

National estimates for independent contractor employees are presented in Table 81. During a typical week, surface coal mines use independent contractor employees for various types of work including: material handling (32.4 percent); drilling and blasting (23.0 percent); construction or reconstruction of mine facilities (21.6 percent); and equipment service or repair of equipment on mine property (19.7 percent).

Tables 82–85 present national estimates for safety, communication, and rescue measures. Cell phones (90.7 percent) are the most frequently used communication system followed by hand-held two-way radios (63.6 percent), and dedicated telephones (48.1 percent). Sixty-one percent of surface coal mines use telephones for emergency early warnings. Approximately 10 percent of surface coal mines report having their own mine rescue team composed of about 13 team members. The majority of mine rescue teams train once a month (76.9 percent).

Table 75. Miner Training Within the Past 12 Months at Surface Coal Mines

Training Conducted by	Percentage of Mines	95% CI
Mine employees		
Annual miner refresher	65.9	(56.1, 75.7)
Newly hired inexperienced miner	55.2	(43.8, 66.6)
Newly hired experienced miner	70.1	(53.2, 86.9)
Outside trainer		
Annual miner refresher	70.1	(60.3, 79.9)
Newly hired inexperienced miner	31.6	(21.2, 42.1)
Newly hired experienced miner	32.4	(15.3, 49.5)
Outside contract trainer		
Annual miner refresher	72.3	(61.7, 82.9)
Newly hired inexperienced miner	77.2	(58.3, 96.1)
Newly hired experienced miner	83.4	(65.1, 100.0)
Outside state grantee		
Annual miner refresher	21.3	(11.2, 31.4)
Newly hired inexperienced miner	24.9	(9.9, 40.0)
Newly hired experienced miner	DSU	DSU
Outside other trainer		
Annual miner refresher	14.1	(7.9, 20.2)
Newly hired inexperienced miner	DSU	DSU
Newly hired experienced miner	DSU	DSU

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 76. Frequency of Periodic Safety Meetings at Surface Coal Mines

Response	Percentage of Mines	95% CI
Less than once a year	DSU	DSU
Annually	DSU	DSU
Less than once a month	8.1	(0.6, 15.5)
Once a month	13.3	(5.5, 21.1)
Once every 2 weeks	6.2	(0.0, 14.0)
Once a week	51.1	(39.0, 63.3)
Several times a week	10.0	(0.8, 19.3)
Daily	7.8	(1.2, 14.4)

Abbreviation: DSU, data suppressed. Note: Data are national estimates.

Table 77. Employee Safety Training Materials and Methods at Surface Coal Mines

Response	Percentage of Mines	95% CI
Lectures	98.2	(95.7, 100.0)
Written materials	88.1	(80.2, 96.1)
Videos	87.2	(77.3, 97.1)
Self-guided interactive computer programs	4.5	(0.4, 8.5)
Demonstrations	73.4	(59.1, 87.7)
Hands-on training exercises	73.7	(59.2, 88.3)
Group exercises (role playing, games, problem solving)	48.4	(36.0, 60.8)
Classroom simulations (e.g., virtual reality)	22.9	(13.0, 32.7)
Worksite simulations	34.6	(21.1, 48.1)
Narrative storytelling	44.0	(28.1, 59.9)
Other	4.7	(0.0, 9.6)

Notes: Data are national estimates; multiple responses permitted.

Table 78. Non-English Languages at Surface Coal Mines

Response	Percentage	95% CI
Employees use a language other than English to communicate	1.9	(0.0, 4.9)
Mining operations provide training materials, signs, or written materials, in language(s) other than English	8.0	(0.0, 16.6)
Language(s) provided[1]		
Spanish	100.0	NA
Other	0.0	NA
Helpful to have training materials, signs, or written materials in other languages, in addition to those already provided	DSU	DSU
Helpful to have training materials, signs, or written materials in language(s) other than English	DSU	DSU

[1]Multiple responses permitted. Abbreviations: DSU, data suppressed; NA, not applicable.

Note: Data are national estimates.

Table 79. Work Schedules at Surface Coal Mines

Response	Production Workers	95% CI	Production Support Workers	95% CI	Preparation Plant/Mill Workers	95% CI
Scheduled days per week (average)	5.6	(5.4, 5.8)	5.4	(5.2, 5.6)	5.1	(4.9, 5.4)
Scheduled hours per day (average)	9.6	(9.0, 10.3)	9.5	(8.8, 10.1)	9.9	(9.4, 10.4)
Actual hours worked per week (average)	49.2	(45.2, 53.2)	45.9	(40.6, 51.2)	46.4	(33.4, 59.3)
Work crews change shifts at active mining site (percentage)	24.2	(11.6, 36.8)	15.8	(7.2, 24.4)	NA	NA
Average time spent traveling to and from active mining site while being paid (hours)	1.8	(1.6, 2.0)	1.7	(1.5, 1.9)	NA	NA

Abbreviation: NA, not applicable. Note: Data are national estimates.

Table 80. Shift Work Schedules at Surface Coal Mines

Response	Production Workers Percentage of Mines	95% CI	Production Support Workers Percentage of Mines	95% CI	Preparation Plant/Mill Workers Percentage of Mines	95% CI
Number of shifts per day						
1 shift	36.2	(24.7, 47.6)	51.5	(37.8, 65.2)	27.2	(5.8, 48.7)
2 shifts	60.5	(48.7, 72.3)	40.8	(26.9, 54.7)	49.9	(29.0, 70.8)
3 shifts	DSU	DSU	DSU	DSU	22.3	(11.0, 33.6)
4 shifts	DSU	DSU	DSU	DSU	DSU	DSU
Rotating shifts	20.9	(11.3, 30.4)	18.2	(8.4, 28.0)	22.6	(10.6, 34.6)
Frequency workers rotate shifts						
Weekly	88.9	(76.1, 100.0)	90.7	(77.6, 100.0)	52.8	(11.9, 93.7)
Twice a month	DSU	DSU	0.0	NA	DSU	DSU
Monthly	0.0	NA	0.0	NA	DSU	DSU
Other	DSU	DSU	DSU	DSU	DSU	DSU
Direction the shift rotates						
Clockwise (day—afternoon—night)	69.3	(47.6, 91.0)	68.5	(37.9, 99.1)	59.0	(16.2, 100.0)
Counterclockwise (night—afternoon—day)	DSU	DSU	DSU	DSU	DSU	DSU
Other	24.8	(4.5, 45.2)	DSU	DSU	DSU	DSU
Unique work shifts	13.8	(3.5, 24.2)	12.4	(3.1, 21.8)	10.5	(3.4, 17.6)

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 81. Activities of Independent Contractor Employees During the Reporting Week at Surface Coal Mines

Response	Percentage of Mines Reporting Contractors	95% CI	Average Number of Contractor Employees	95% CI	Average Total Hours	95% CI
Mine development	DSU	DSU	DSU	DSU	DSU	DSU
Construction or reconstruction of mine facilities	21.6	(14.0, 29.2)	16.9	(0.0, 33.8)	641.0	(0.0, 1,320.3)
Demolition of mine facilities	0.0	NA	NA	NA	NA	NA
Construction of dams	DSU	DSU	DSU	DSU	DSU	DSU
Excavation or earthmoving activities (involving mobile equipment)	11.0	(4.7, 17.4)	13.2	(7.8, 18.5)	500.8	(194.4, 807.2)
Equipment installation	DSU	DSU	DSU	DSU	DSU	DSU
Equipment service or repair of equipment on mine property (exceeding 5 consecutive days)	19.7	(10.0, 29.4)	4.0	(2.6, 5.4)	155.7	(89.4, 222.1)
Material handling (within mine property)	32.4	(21.8, 43.0)	9.5	(5.5, 13.5)	222.6	(103.4, 341.8)
Drilling and blasting	23.0	(15.0, 31.0)	2.7	(1.8, 3.7)	80.8	(32.3, 129.2)
Production support work	DSU	DSU	DSU	DSU	DSU	DSU
Mineral extraction	0.0	NA	NA	NA	NA	NA
Other work	4.8	(0.0, 10.8)	4.4	(0.0, 16.0)	120.6	(0.0, 530.2)

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 82. Communication Devices and Systems at Surface Coal Mines

Response	Percentage of Mines	95% CI
Dedicated telephones	48.1	(35.5, 60.7)
Mine page phones	20.2	(10.6, 29.8)
Trolley phones	0.0	NA
Shaft or hoist phones	NA	NA
Cell phones	90.7	(82.7, 98.8)
Voice over internet protocol (VOIP) phones	0.0	NA
Hand-held two-way radios	63.6	(48.8, 78.4)
Wireless paging devices	10.6	(2.3, 18.9)
Leaky feeder communications system (not running a PED)	DSU	DSU
Personal emergency device (PED) cap lamp/pager	0.0	NA
Through-the-Earth (TTE) technology (other than a PED)	0.0	NA
Inductive coupled radios	DSU	DSU
Ethernet	11.2	(5.7, 16.7)
TRACKER tagging system	0.0	NA
Longwall face communication systems	NA	NA
None of the above	DSU	DSU
Other	23.0	(11.4, 34.5)

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 83. Personal Locators, Trackers, and Devices at Surface Coal Mines

Response	Percentage of Mines	95% CI
Electronic or computerized tagging or tracking	0.0	NA
Tag boards	4.2	(0.2, 8.3)
Reflective vests/clothing	41.2	(26.8, 55.6)
Chemical light sticks	6.5	(0.7, 12.2)
Lighted vests	0.0	NA
Laser lights/pointers	0.0	NA
Strobe lights	23.9	(12.3, 35.5)
None of the above	44.7	(30.4, 59.0)
Other	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 84. Emergency Early Warning Methods at Surface Coal Mines

Response	Percentage of Mines	95% CI
Stench gas	0.0	NA
Audible systems	35.4	(25.8, 44.9)
Visual systems	17.9	(7.3, 28.4)
Pager phones	18.3	(8.5, 28.2)
Telephones	60.7	(48.2, 73.1)
Messengers	9.3	(2.4, 16.3)
Electronic personal communication systems	DSU	DSU
None of the above	27.8	(18.4, 37.2)
Other	8.2	(1.8, 14.6)

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 85. Rescue Teams at Surface Coal Mines

Response	Percentage of Mines	95% CI
Mine has own rescue team	9.7	(4.2, 15.2)
Average number of rescue team members	12.8	(8.5, 17.2)
Frequency of team training		
Less than once a year	0.0	NA
Annually	DSU	DSU
Less than once a month	0.0	NA
Once a month	76.9	(44.6, 100.0)
Once every 2 weeks	0.0	NA
Once a week	DSU	DSU
Other time interval	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Mine Statistics for Metal Mines

Summary of Mine Statistics for Metal Mines

The data for training and non-English languages can be found in Tables 86–89. For the U.S. metal mining industry, the weighted survey estimates indicate that more training is conducted by the mine's employees including: annual refresher training (78.1 percent); newly hired inexperienced miner training (72.0 percent); and newly hired experienced miner training (70.7 percent) when compared to the mine's use of outside trainers. Lectures (92.1 percent), written materials (87.8 percent), and videos (80.8 percent) are the top three methods and materials used for training. Estimates from the survey indicate that 39.8 percent of all metal mines have daily employee safety meetings. Approximately four percent of metal mine employees use a language other than English.

Tables 90 and 91 present the national estimates for work schedules and shift work. The average number of hours worked per week is 40.1 for production workers, 39.5 for production support workers, and 43.2 for preparation plant/mill workers. The majority of metal mines operate two shifts per day for production workers (54.7 percent) and preparation plant/mill workers (55.2 percent) and one shift per day for production support workers (57.2 percent).

National estimates for independent contractor employees are presented in Table 92. During a typical week, metal mines use independent contractor employees for various types of work including: equipment service or repair of equipment on mine property (28.0 percent); construction or reconstruction of mine facilities (24.3 percent); excavation or earth moving activities (23.0 percent); and drilling and blasting (21.8 percent).

Tables 93–96 present national estimates for safety, communication, and rescue measures. Hand-held two-way radios (74.3 percent) are the most frequently used communication system followed by cell phones (70.6 percent), and dedicated telephones (61.1 percent). Reflective vests/clothing (46.0 percent) and tag boards (43.4 percent) are the most frequently used personal locators/trackers in metal mines. Forty-four percent of metal mines use audible systems for emergency early warnings. Thirty-six percent of these mines report having their own mine rescue team composed of approximately 20 team members. The majority of mine rescue teams train once a month (65.5 percent).

Table 86. Miner Training Within the Past 12 Months at Metal Mines

Training Conducted by	Percentage of Mines	95% CI
Mine employees		
Annual miner refresher	78.1	(67.3, 89.0)
Newly hired inexperienced miner	72.0	(58.6, 85.4)
Newly hired experienced miner	70.7	(58.2, 83.1)
Outside trainer		
Annual miner refresher	44.2	(31.5, 56.8)
Newly hired inexperienced miner	32.5	(19.3, 45.8)
Newly hired experienced miner	22.4	(12.7, 32.2)
Outside contract trainer		
Annual miner refresher	58.3	(41.7, 74.9)
Newly hired inexperienced miner	65.8	(44.3, 87.2)
Newly hired experienced miner	75.4	(53.6, 97.2)
Outside state grantee		
Annual miner refresher	39.8	(24.0, 55.7)
Newly hired inexperienced miner	34.2	(12.8, 55.7)
Newly hired experienced miner	DSU	DSU
Outside other trainer		
Annual miner refresher	DSU	DSU
Newly hired inexperienced miner	0.0	NA
Newly hired experienced miner	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 87. Frequency of Periodic Safety Meetings at Metal Mines

Response	Percentage of Mines	95% CI
Less than once a year	DSU	DSU
Annually	0.0	NA
Less than once a month	DSU	DSU
Once a month	11.5	(5.9, 17.2)
Once every 2 weeks	DSU	DSU
Once a week	33.2	(22.2, 44.3)
Several times a week	10.1	(2.8, 17.4)
Daily	39.8	(27.3, 52.3)

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 88. Employee Safety Training Materials and Methods at Metal Mines

Response	Percentage of Mines	95% CI
Lectures	92.1	(86.2, 98.1)
Written materials	87.8	(79.6, 95.9)
Videos	80.8	(72.1, 89.5)
Self-guided interactive computer programs	21.6	(12.9, 30.3)
Demonstrations	70.2	(59.9, 80.4)
Hands-on training exercises	78.2	(68.4, 88.1)
Group exercises (role playing, games, problem solving)	39.0	(25.8, 52.1)
Classroom simulations (e.g., virtual reality)	19.3	(10.5, 28.1)
Worksite simulations	32.3	(21.5, 43.2)
Narrative storytelling	50.3	(38.5, 62.2)
Other	10.5	(3.6, 17.4)

Notes: Data are national estimates; multiple responses permitted.

Table 89. Non-English Languages at Metal Mines

Response	Percentage	95% CI
Employees use a language other than English to communicate	3.8	(0.3, 7.3)
Mining operations provide training materials, signs, or written materials, in language(s) other than English	18.6	(9.4, 27.9)
Language(s) provided[1]		
Spanish	100.0	NA
Other	0.0	NA
Helpful to have training materials, signs, or written materials in other languages, in addition to those already provided	DSU	DSU
Helpful to have training materials, signs, or written materials in language(s) other than English	15.7	(5.3, 26.0)

[1]Multiple responses permitted. Abbreviations: DSU, data suppressed; NA, not applicable.

Note: Data are national estimates.

Table 90. Work Schedules at Metal Mines

Response	Production Workers	95% CI	Production Support Workers	95% CI	Preparation Plant/Mill Workers	95% CI
Scheduled days per week (average)	4.8	(4.4, 5.1)	4.8	(4.5, 5.0)	4.9	(4.4, 5.3)
Scheduled hours per day (average)	9.8	(9.1, 10.4)	9.8	(8.9, 10.8)	9.7	(9.0, 10.4)
Actual hours worked per week (average)	40.1	(35.1, 45.1)	39.5	(36.4, 42.7)	43.2	(38.7, 47.7)
Work crews change shifts at active mining site (percentage)	26.1	(14.5, 37.7)	10.5	(2.9, 18.2)	NA	NA
Average time spent traveling to and from active mining site while being paid (hours)	1.8	(1.6, 2.0)	1.7	(1.5, 1.9)	NA	NA

Abbreviation: NA, not applicable. Note: Data are national estimates.

Table 91. Shift Work Schedules at Metal Mines

Response	Production Workers Percentage of Mines	95% CI	Production Support Workers Percentage of Mines	95% CI	Preparation Plant/Mill Workers Percentage of Mines	95% CI
Number of shifts per day						
1 shift	35.3	(20.6, 50.0)	57.2	(45.0, 69.4)	27.4	(14.8, 40.0)
2 shifts	54.7	(40.4, 69.1)	34.8	(22.2, 47.3)	55.2	(39.8, 70.5)
3 shifts	10.0	(2.3, 17.7)	8.0	(1.0, 15.0)	17.4	(5.5, 29.3)
4 shifts	0.0	NA	0.0	NA	0.0	NA
Rotating shifts	59.3	(45.6, 73.0)	42.2	(30.4, 54.0)	72.4	(60.1, 84.8)
Frequency workers rotate shifts						
Weekly	59.5	(42.5, 76.5)	45.1	(24.6, 65.6)	57.4	(39.1, 75.7)
Twice a month	17.0	(4.3, 29.8)	28.9	(9.7, 48.0)	DSU	DSU
Monthly	0.0	NA	DSU	DSU	DSU	DSU
Other	23.5	(8.9, 38.1)	22.5	(7.4, 37.7)	22.3	(8.0, 36.6)
Direction the shift rotates						
Clockwise (day—afternoon—night)	58.2	(41.2, 75.1)	47.9	(27.0, 68.9)	49.5	(29.7, 69.2)
Counterclockwise (night—afternoon—day)	DSU	DSU	DSU	DSU	DSU	DSU
Other	32.9	(16.7, 49.1)	41.1	(20.5, 61.7)	33.3	(16.7, 49.8)
Unique work shifts	27.7	(15.4, 40.0)	14.0	(5.5, 22.6)	13.7	(4.3, 23.1)

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 92. Activities of Independent Contractor Employees During the Reporting Week at Metal Mines

Response	Percentage of Mines Reporting Contractors	95% CI	Average Number of Contractor Employees	95% CI	Average Total Hours	95% CI
Mine development	DSU	DSU	DSU	DSU	DSU	DSU
Construction or reconstruction of mine facilities	24.3	(14.7, 33.8)	65.9	(28.8, 103.0)	2,245.5	(849.0, 3641.9)
Demolition of mine facilities	DSU	DSU	DSU	DSU	DSU	DSU
Construction of dams	DSU	DSU	DSU	DSU	DSU	DSU
Excavation or earthmoving activities (involving mobile equipment)	23.0	(12.0, 34.1)	18.6	(9.2, 28.0)	663.2	(273.3, 1,053.0)
Equipment installation	8.4	(1.4, 15.4)	33.7	(0.0, 73.5)	1,643.7	(0.0, 3,644.1)
Equipment service or repair of equipment on mine property (exceeding 5 consecutive days)	28.0	(18.7, 37.2)	40.1	(0.0, 99.3)	771.9	(0.0, 1,646.7)
Material handling (within mine property)	15.2	(6.4, 24.0)	20.4	(5.7, 35.2)	647.7	(22.1, 1273.2)
Drilling and blasting	21.8	(12.6, 30.9)	18.9	(1.2, 36.5)	726.8	(0.0, 1,496.6)
Production support work	DSU	DSU	DSU	DSU	DSU	DSU
Mineral extraction	DSU	DSU	DSU	DSU	DSU	DSU
Other work	10.3	(3.2, 17.5)	27.2	(0.0, 55.1)	1069.4	(0.0, 2,204.6)

Abbreviation: DSU, data suppressed. Note: Data are national estimates.

Table 93. Communication Devices and Systems at Metal Mines

Response	Percentage of Mines	95% CI
Dedicated telephones	61.1	(50.2, 72.1)
Mine page phones	42.0	(32.9, 51.2)
Trolley phones	0.0	NA
Shaft or hoist phones	DSU	DSU
Cell phones	70.6	(60.7, 80.4)
Voice over internet protocol (VOIP) phones	14.6	(6.8, 22.4)
Hand-held two-way radios	74.3	(63.5, 85.0)
Wireless paging devices	13.8	(6.9, 20.7)
Leaky feeder communications system (not running a PED)	23.7	(16.6, 30.7)
Personal emergency device (PED) cap lamp/pager	DSU	DSU
Through-the-Earth (TTE) technology (other than a PED)	DSU	DSU
Inductive coupled radios	0.0	NA
Ethernet	12.8	(4.3, 21.3)
TRACKER tagging system	DSU	DSU
Longwall face communication systems	NA	NA
None of the above	0.0	NA
Other	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 94. Personal Locators, Trackers, and Devices at Metal Mines

Response	Percentage of Mines	95% CI
Electronic or computerized tagging or tracking	DSU	DSU
Tag boards	43.4	(36.3, 50.4)
Reflective vests/clothing	46.0	(34.7, 57.3)
Chemical light sticks	0.0	NA
Lighted vests	DSU	DSU
Laser lights/pointers	DSU	DSU
Strobe lights	19.3	(10.2, 28.4)
None of the above	39.0	(31.2, 46.8)
Other	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 95. Emergency Early Warning Methods at Metal Mines

Response	Percentage of Mines	95% CI
Stench gas	28.0	(19.4, 36.6)
Audible systems	44.2	(33.2, 55.3)
Visual systems	15.9	(7.1, 24.7)
Pager phones	36.4	(27.2, 45.5)
Telephones	40.8	(29.3, 52.3)
Messengers	13.3	(5.2, 21.5)
Electronic personal communication systems	0.0	NA
None of the above	17.2	(9.7, 24.6)
Other	23.5	(12.1, 34.8)

Abbreviation: NA, not applicable. Notes: Data are national estimates; multiple responses permitted.

Table 96. Rescue Teams at Metal Mines

Response	Percentage of Mines	95% CI
Mine has own rescue team	36.3	(25.9, 46.7)
Average number of rescue team members	20.3	(15.4, 25.1)
Frequency of team training		
Less than once a year	0.0	NA
Annually	DSU	DSU
Less than once a month	DSU	DSU
Once a month	65.5	(46.2, 84.8)
Once every 2 weeks	DSU	DSU
Once a week	DSU	DSU
Other time interval	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Mine Statistics for Underground Metal Mines

Summary of Mine Statistics for Underground Metal Mines

The data for training and non-English languages can be found in Tables 97–100. For underground metal mines, the weighted survey estimates indicate that more training is conducted by the mine's employees including: annual refresher training (95.9 percent), newly hired inexperienced miner training (86.0 percent), and newly hired experienced miner training (86.0 percent) when compared to the mine's use of outside trainers. Lectures (100.0 percent), written materials (85.5 percent), and hands-on training exercises (81.4 percent) are the top three methods and materials used for training. Estimates from the survey indicate that 41.3 percent of underground metal mines have daily safety meetings. Approximately seven percent of underground metal mine employees use a language other than English.

Tables 101 and 102 present the national estimates for work schedules and shift work. The average number of hours worked per week is 40.0 for production workers, 37.6 for production support workers, and 39.9 for preparation plant/mill workers. The majority of underground metal mines operate two shifts per day for production workers (74.2 percent) and preparation plant/mill workers (54.5 percent) and one shift per day for production support workers (50.1 percent).

National estimates for independent contractor employees are presented in Table 103. During a typical week, underground metal mines report using independent contractor employees for equipment service or repair of equipment on mine property (31.1 percent). The other data in this table have all been suppressed due to a survey count of less than five responses.

Tables 104–109 present national estimates for safety, communication, and rescue measures. Mine page phones (80.6 percent) are the most frequently used communication system followed by a leaky feeder communication system (64.6 percent), dedicated telephones (50.2 percent), and hand-held two-way radios (50.2 percent). Tag boards (100.0 percent) and reflective vests/clothing (66.0 percent) are the most frequently used personal locators/trackers in underground metal mines. Signage (91.8 percent) and colored reflectors (43.0 percent) are the most frequently reported escape aids. First aid kits (91.8 percent), belt-worn self-contained self-rescuers (SCSRs) (54.0 percent), and defibrillators (54.0 percent) are the top three emergency equipment and supplies found in these mines. Seventy-eight percent of underground mines use pager phones for emergency early warnings. Approximately 47 percent of underground metal mines report having their own mine rescue team composed of 16 team members. The majority of mine rescue teams train once a month (63.1 percent).

Table 97. Miner Training Within the Past 12 Months at Underground Metal Mines

Training Conducted by	Percentage of Mines	95% CI
Mine employees		
Annual miner refresher	95.9	(88.0, 100.0)
Newly hired inexperienced miner	86.0	(70.9, 100.0)
Newly hired experienced miner	86.0	(71.6, 100.0)
Outside trainer		
Annual miner refresher	34.4	(11.4, 57.3)
Newly hired inexperienced miner	30.9	(9.3, 52.5)
Newly hired experienced miner	25.7	(7.7, 43.7)
Outside contract trainer		
Annual miner refresher	76.1	(48.4, 100.0)
Newly hired inexperienced miner	86.7	(67.3, 100.0)
Newly hired experienced miner	100.0	NA
Outside state grantee		
Annual miner refresher	DSU	DSU
Newly hired inexperienced miner	DSU	DSU
Newly hired experienced miner	0.0	NA
Outside other trainer		
Annual miner refresher	0.0	NA
Newly hired inexperienced miner	0.0	NA
Newly hired experienced miner	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 98. Frequency of Periodic Safety Meetings at Underground Metal Mines

Response	Percentage of Mines	95% CI
Less than once a year	0.0	NA
Annually	0.0	NA
Less than once a month	0.0	NA
Once a month	DSU	DSU
Once every 2 weeks	0.0	NA
Once a week	40.2	(18.9, 61.4)
Several times a week	DSU	DSU
Daily	41.3	(21.3, 61.3)

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 99. Employee Safety Training Materials and Methods at Underground Metal Mines

Response	Percentage of Mines	95% CI
Lectures	100.0	NA
Written materials	85.5	(69.7, 100.0)
Videos	58.5	(39.5, 77.5)
Self-guided interactive computer programs	DSU	DSU
Demonstrations	77.3	(61.4, 93.3)
Hands-on training exercises	81.4	(63.8, 99.1)
Group exercises (role playing, games, problem solving)	31.3	(8.8, 53.8)
Classroom simulations (e.g., virtual reality)	DSU	DSU
Worksite simulations	23.3	(4.6, 42.1)
Narrative storytelling	50.6	(27.9, 73.3)
Other	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 100. Non-English Languages at Underground Metal Mines

Response	Percentage	95% CI
Employees use a language other than English to communicate	7.4	(0.0, 16.0)
Mining operations provide training materials, signs, or written materials, in language(s) other than English	22.3	(4.5, 40.0)
Which Language(s) are provided[1]		
Spanish	100.0	NA
Other	0.0	NA
Helpful to have training materials, signs, or written materials in other languages, in addition to those already provided	DSU	DSU
Helpful to have training materials, signs, or written materials in language(s) other than English	DSU	DSU

[1]Multiple responses permitted. Abbreviations: DSU, data suppressed; NA, not applicable.

Note: Data are national estimates.

Table 101. Work Schedules at Underground Metal Mines

Response	Production Workers	95% CI	Production Support Workers	95% CI	Preparation Plant/Mill Workers	95% CI
Scheduled days per week (average)	5.0	(4.3, 5.6)	4.7	(4.3, 5.1)	4.9	(4.3, 5.5)
Scheduled hours per day (average)	10.3	(9.8, 10.9)	9.6	(9.0, 10.2)	9.7	(8.7, 10.8)
Actual hours worked per week (average)	40.0	(32.2, 47.7)	37.6	(31.2, 44.0)	39.9	(27.9, 51.9)
Work crews change shifts at active mining site (percentage)	DSU	DSU	DSU	DSU	NA	NA
Average time spent traveling to and from active mining site while being paid (hours)	NA	NA	2.0	(1.9, 2.0)	NA	NA

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 102. Shift Work Schedules at Underground Metal Mines

Response	Production Workers Percentage of Mines	95% CI	Production Support Workers Percentage of Mines	95% CI	Preparation Plant/Mill Workers Percentage of Mines	95% CI
Number of shifts per day						
1 shift	DSU	DSU	50.1	(30.6, 69.6)	DSU	DSU
2 shifts	74.2	(54.5, 93.9)	44.2	(23.8, 64.7)	54.5	(24.9, 84.2)
3 shifts	DSU	DSU	DSU	DSU	DSU	DSU
4 shifts	0.0	NA	0.0	NA	0.0	NA
Rotating shifts	80.4	(63.0, 97.8)	56.2	(38.0, 74.5)	65.4	(38.8, 92.1)
Frequency workers rotate shifts						
Weekly	59.5	(33.2, 85.7)	47.3	(15.4, 79.1)	DSU	DSU
Twice a month	DSU	DSU	DSU	DSU	DSU	DSU
Monthly	0.0	NA	0.0	NA	DSU	DSU
Other	DSU	DSU	DSU	DSU	0.0	NA
Direction the shift rotates						
Clockwise (day—afternoon—night)	67.2	(41.6, 92.8)	46.0	(16.1, 75.9)	66.7	(31.4, 100.0)
Counterclockwise (night—afternoon—day)	DSU	DSU	DSU	DSU	DSU	DSU
Other	DSU	DSU	DSU	DSU	DSU	DSU
Unique work shifts	DSU	DSU	DSU	DSU	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 103. Activities of Independent Contractor Employees During the Reporting Week at Underground Metal Mines

Response	Percentage of Mines Reporting Contractors	95% CI	Average Number of Contractor Employees	95% CI	Average Total Hours	95% CI
Mine development	DSU	DSU	DSU	DSU	DSU	DSU
Construction or reconstruction of mine facilities	DSU	DSU	DSU	DSU	DSU	DSU
Demolition of mine facilities	0.0	NA	NA	NA	NA	NA
Construction of dams	DSU	DSU	DSU	DSU	DSU	DSU
Excavation or earthmoving activities (involving mobile equipment)	DSU	DSU	DSU	DSU	DSU	DSU
Equipment installation	DSU	DSU	DSU	DSU	DSU	DSU
Equipment service or repair of equipment on mine property (exceeding 5 consecutive days)	31.1	(14.6, 47.6)	4.3	(0.3, 8.3)	213.0	(0.0, 527.6)
Material handling (within mine property)	DSU	DSU	DSU	DSU	DSU	DSU
Drilling and blasting	DSU	DSU	DSU	DSU	DSU	DSU
Production support work	DSU	DSU	DSU	DSU	DSU	DSU
Mineral extraction	DSU	DSU	DSU	DSU	DSU	DSU
Other work	DSU	DSU	DSU	DSU	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 104. Communication Devices and Systems at Underground Metal Mines

Response	Percentage of Mines	95% CI
Dedicated telephones	50.2	(27.1, 73.3)
Mine page phones	80.6	(65.4. 95.9)
Trolley phones	0.0	NA
Shaft or hoist phones	DSU	DSU
Cell phones	48.7	(25.7, 71.7)
Voice over internet protocol (VOIP) phones	DSU	DSU
Hand-held two-way radios	50.2	(28.3, 72.1)
Wireless paging devices	0.0	NA
Leaky feeder communications system (not running a PED)	64.6	(46.5, 82.8)
Personal emergency device (PED) cap lamp/pager	DSU	DSU
Through-the-Earth (TTE) technology (other than a PED)	0.0	NA
Inductive coupled radios	0.0	NA
Ethernet	DSU	DSU
TRACKER tagging system	DSU	DSU
Longwall face communication systems	NA	NA
None of the above	0.0	NA
Other	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 105. Personal Locators, Trackers, and Devices at Underground Metal Mines

Response	Percentage of Mines	95% CI
Electronic or computerized tagging or tracking	0.0	NA
Tag boards	100.0	NA
Reflective vests/clothing	66.0	(43.6, 88.4)
Chemical light sticks	0.0	NA
Lighted vests	DSU	DSU
Laser lights/pointers	DSU	DSU
Strobe lights	DSU	DSU
None of the above	0.0	NA
Other	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 106. Emergency Early Warning Methods at Underground Metal Mines

Response	Percentage of Mines	95% CI
Stench gas	75.3	(53.5, 97.1)
Audible systems	24.7	(5.6, 43.8)
Visual systems	0.0	NA
Pager phones	77.9	(60.2, 95.6)
Telephones	25.9	(8.4, 43.4)
Messengers	DSU	DSU
Electronic personal communication systems	0.0	NA
None of the above	0.0	NA
Other	29.2	(8.2, 50.3)

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 107. Rescue Teams at Underground Metal Mines

Response	Percentage of Mines	95% CI
Mine has own rescue team	47.1	(29.2, 65.0)
Average number of rescue team members	15.6	(9.2, 22.0)
Frequency of team training		
Less than once a year	0.0	NA
Annually	DSU	DSU
Less than once a month	DSU	DSU
Once a month	63.1	(30.5, 95.8)
Once every 2 weeks	DSU	DSU
Once a week	0.0	NA
Other time interval	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 108. Emergency Equipment and Supplies at Underground Metal Mines

Response	Percentage of Mines	95% CI
Belt-worn self-contained self-rescuers (SCSRs)	54.0	(33.6, 74.4)
Cached self-contained self-rescuers (SCSRs)	DSU	DSU
Filter self-rescuers (FSRs)	37.8	(18.2, 57.4)
Stationary emergency refuge chambers	49.2	(27.3, 71.2)
Mobile emergency refuge chambers	DSU	DSU
Sealing materials	34.8	(10.7, 58.8)
Cached water/food supplies	39.3	(18.8, 59.8)
First aid kits	91.8	(80.4, 100.0)
Defibrillator	54.0	(32.2, 75.8)
None of the above	DSU	DSU
Other	DSU	DSU

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 109. Escape Aids at Underground Metal Mines

Response	Percentage of Mines	95% CI
Lifelines	DSU	DSU
Directional lifelines	0.0	NA
Signage	91.8	(80.4, 100.0)
Colored reflectors	43.0	(24.0, 62.0)
Lighting	DSU	DSU
Strobe lights	0.0	NA
None of the above	DSU	DSU
Other	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Mine Statistics for Surface Metal Mines

Summary of Mine Statistics for Surface Metal Mines

The data for training and non-English languages can be found in Tables 110–113. For surface metal mines, the weighted survey estimates indicate that more training is conducted by the mine's employees including: annual refresher training (68.5 percent); newly hired inexperienced miner training (64.4 percent); and newly hired experienced miner training (62.4 percent) when compared to the mine's use of outside trainers. Videos (92.9 percent), written materials (89.0 percent), and lectures (87.9 percent) are the top three methods and materials used for training. Estimates from the survey indicate that 39.0 percent of surface metal mines have daily employee safety meetings. Approximately two percent of surface metal mine employees use a language other than English.

Tables 114 and 115 present the national estimates for work schedules and shift work. The average number of hours worked per week is 40.2 for production workers, 40.8 for production support workers, and 44.7 for preparation plant/mill workers. The majority of surface metal mines operate one shift per day for production workers (44.2 percent) and production support workers (61.6 percent) and two shifts per day for preparation plant/mill workers (55.5 percent).

National estimates for independent contractor employees are presented in Table 116. During a typical week, surface metal mines use independent contractor employees for various types of work including: construction or reconstruction of mine facilities (30.2 percent); equipment service or repair of equipment on mine property (26.3 percent); excavation or earthmoving activities (24.5 percent), and drilling and blasting (22.3 percent).

Tables 117–120 present national estimates for safety, communication, and rescue measures. Hand-held two-way radios (87.0 percent) are the most frequently used communication system followed by cell phones (82.2 percent), and dedicated telephones (66.9 percent). Fifty-four percent of surface metal mines use audible systems for emergency early warnings. Approximately 31 percent of surface metal mines report having their own mine rescue team composed of about 24 team members. The majority of mine rescue teams train once a month (67.4 percent).

Table 110. Miner Training Within the Past 12 Months at Surface Metal Mines

Training Conducted by	Percentage of Mines	95% CI
Mine employees		
Annual miner refresher	68.5	(52.8, 84.2)
Newly hired inexperienced miner	64.4	(45.7, 83.1)
Newly hired experienced miner	62.4	(45.0, 79.8)
Outside trainer		
Annual miner refresher	49.5	(34.7, 64.3)
Newly hired inexperienced miner	33.4	(16.8, 50.0)
Newly hired experienced miner	20.7	(9.2, 32.1)
Outside contract trainer		
Annual miner refresher	51.6	(31.6, 71.6)
Newly hired inexperienced miner	55.2	(26.1, 84.4)
Newly hired experienced miner	58.8	(25.7, 92.0)
Outside state grantee		
Annual miner refresher	40.1	(21.4, 58.8)
Newly hired inexperienced miner	44.8	(15.6, 73.9)
Newly hired experienced miner	DSU	DSU
Outside other trainer		
Annual miner refresher	DSU	DSU
Newly hired inexperienced miner	0.0	NA
Newly hired experienced miner	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 111. Frequency of Periodic Safety Meetings at Surface Metal Mines

Response	Percentage of Mines	95% CI
Less than once a year	DSU	DSU
Annually	0.0	NA
Less than once a month	DSU	DSU
Once a month	15.6	(8.1, 23.1)
Once every 2 weeks	DSU	DSU
Once a week	29.5	(16.7, 42.2)
Several times a week	DSU	DSU
Daily	39.0	(23.1, 54.9)

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 112. Employee Safety Training Materials and Methods at Surface Metal Mines

Response	Percentage of Mines	95% CI
Lectures	87.9	(78.8, 97.0)
Written materials	89.0	(79.8, 98.2)
Videos	92.9	(85.5, 100.0)
Self-guided interactive computer programs	31.1	(18.5, 43.7)
Demonstrations	66.3	(53.1, 79.5)
Hands-on training exercises	76.5	(64.8, 88.3)
Group exercises (role playing, games, problem solving)	43.1	(26.7, 59.5)
Classroom simulations (e.g., virtual reality)	22.5	(11.2, 33.7)
Worksite simulations	37.2	(23.9, 50.6)
Narrative storytelling	50.2	(36.6, 63.8)
Other	13.4	(4.0, 22.8)

Notes: Data are national estimates; multiple responses permitted.

Table 113. Non-English Languages at Surface Metal Mines

Response	Percentage	95% CI
Employees use a language other than English to communicate	1.9	(0.0, 4.5)
Mining operations provide training materials, signs, or written materials, in language(s) other than English	16.6	(6.4, 26.9)
Which Language(s) are provided[1]		
Spanish	100.0	NA
Other	0.0	NA
Helpful to have training materials, signs, or written materials in other languages, in addition to those already provided	0.0	NA
Helpful to have training materials, signs, or written materials in language(s) other than English	DSU	DSU

[1]Multiple responses permitted. Abbreviations: DSU, data suppressed; NA, not applicable.

Note: Data are national estimates.

Table 114. Work Schedules at Surface Metal Mines

Response	Production Workers	95% CI	Production Support Workers	95% CI	Preparation Plant/Mill Workers	95% CI
Scheduled days per week (average)	4.7	(4.2, 5.1)	4.8	(4.4, 5.1)	4.9	(4.3, 5.5)
Scheduled hours per day (average)	9.5	(8.5, 10.4)	9.9	(8.4, 11.4)	9.7	(8.8, 10.6)
Actual hours worked per week (average)	40.2	(33.6, 46.8)	40.8	(37.6, 44.0)	44.7	(40.8, 48.6)
Work crews change shifts at active mining site (percentage)	31.1	(16.4, 45.9)	14.4	(3.3, 25.4)	NA	NA
Average time spent traveling to and from active mining site while being paid (hours)	1.7	(1.4, 1.9)	1.5	(1.2, 1.9)	NA	NA

Abbreviation: NA, not applicable. Note: Data are national estimates.

Table 115. Shift Work Schedules at Surface Metal Mines

Response	Production Workers		Production Support Workers		Preparation Plant/Mill Workers	
	Percentage of Mines	95% CI	Percentage of Mines	95% CI	Percentage of Mines	95% CI
Number of shifts per day						
1 shift	44.2	(24.4, 64.1)	61.6	(46.0, 77.3)	24.2	(10.3, 38.0)
2 shifts	43.6	(25.3, 62.0)	28.8	(13.0, 44.6)	55.5	(37.4, 73.5)
3 shifts	12.1	(1.6, 22.7)	DSU	DSU	20.4	(5.4, 35.4)
4 shifts	0.0	NA	0.0	NA	0.0	NA
Rotating shifts	47.2	(29.8, 64.7)	33.4	(18.4, 48.4)	75.6	(62.2, 88.9)
Frequency workers rotate shifts						
Weekly	59.5	(37.6, 81.4)	42.9	(16.2, 69.6)	60.3	(39.7, 80.8)
Twice a month	DSU	DSU	DSU	DSU	DSU	DSU
Monthly	0.0	NA	DSU	DSU	DSU	DSU
Other	30.4	(10.5, 50.3)	35.7	(12.1, 59.3)	31.0	(11.9, 50.1)
Direction the shift rotates						
Clockwise (day—afternoon—night)	49.4	(27.0, 71.8)	50.0	(20.0, 80.0)	42.7	(20.1, 65.4)
Counterclockwise (night—afternoon—day)	DSU	DSU	0.0	NA	DSU	DSU
Other	40.5	(18.6, 62.4)	50.0	(20.0, 80.0)	39.7	(20.2, 59.2)
Unique work shifts	29.7	(14.2, 45.2)	DSU	DSU	19.9	(6.3, 33.4)

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 116. Activities of Independent Contractor Employees During the Reporting Week at Surface Metal Mines

Response	Percentage of Mines Reporting Contractors	95% CI	Average Number of Contractor Employees	95% CI	Average Total Hours	95% CI
Mine development	DSU	DSU	DSU	DSU	DSU	DSU
Construction or reconstruction of mine facilities	30.2	(16.9, 43.4)	68.6	(27.1, 110.1)	2,613.6	(948.0, 4,279.1)
Demolition of mine facilities	DSU	DSU	DSU	DSU	DSU	DSU
Construction of dams	0.0	NA	NA	NA	NA	NA
Excavation or earthmoving activities (involving mobile equipment)	24.5	(11.1, 37.9)	19.6	(8.2, 31.0)	639.1	(188.5, 1,089.8)
Equipment installation	9.8	(1.0, 18.6)	43.3	(0.0, 88.4)	2,112.2	(0.0, 4,398.7)
Equipment service or repair of equipment on mine property (exceeding 5 consecutive days)	26.3	(15.1, 37.4)	63.0	(0.0, 155.6)	1,131.2	(0.0, 2,488.8)
Material handling (within mine property)	15.0	(4.4, 25.6)	29.9	(9.6, 50.1)	970.5	(67.1, 1,873.8)
Drilling and blasting	22.3	(11.0, 33.6)	21.7	(0.0, 46.8)	798.3	(0.0, 1,894.4)
Production support work	DSU	DSU	DSU	DSU	DSU	DSU
Mineral extraction	0.0	NA	NA	NA	NA	NA
Other work	DSU	DSU	DSU	DSU	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 117. Communication Devices and Systems at Surface Metal Mines

Response	Percentage of Mines	95% CI
Dedicated telephones	66.9	(55.1, 78.8)
Mine page phones	21.6	(10.3, 32.8)
Trolley phones	0.0	NA
Shaft or hoist phones	NA	NA
Cell phones	82.2	(73.2, 91.2)
Voice over internet protocol (VOIP) phones	15.5	(5.7, 25.3)
Hand-held two-way radios	87.0	(75.2, 98.8)
Wireless paging devices	21.1	(10.5, 31.8)
Leaky feeder communications system (not running a PED)	DSU	DSU
Personal emergency device (PED) cap lamp/pager	DSU	DSU
Through-the-Earth (TTE) technology (other than a PED)	DSU	DSU
Inductive coupled radios	0.0	NA
Ethernet	13.8	(3.7, 24.0)
TRACKER tagging system	0.0	NA
Longwall face communication systems	NA	NA
None of the above	0.0	NA
Other	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 118. Personal Locators, Trackers, and Devices at Surface Metal Mines

Response	Percentage of Mines	95% CI
Electronic or computerized tagging or tracking	DSU	DSU
Tag boards	12.6	(3.1, 22.2)
Reflective vests/clothing	35.2	(23.3, 47.1)
Chemical light sticks	0.0	NA
Lighted vests	DSU	DSU
Laser lights/pointers	DSU	DSU
Strobe lights	19.3	(8.1, 30.5)
None of the above	60.2	(49.5, 70.8)
Other	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 119. Emergency Early Warning Methods at Surface Metal Mines

Response	Percentage of Mines	95% CI
Stench gas	DSU	DSU
Audible systems	54.2	(40.3, 68.0)
Visual systems	23.9	(10.6, 37.3)
Pager phones	15.3	(5.3, 25.3)
Telephones	48.4	(33.3, 63.5)
Messengers	9.8	(1.0, 18.6)
Electronic personal communication systems	0.0	NA
None of the above	25.9	(14.7, 37.1)
Other	20.6	(7.1, 34.0)

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 120. Rescue Teams at Surface Metal Mines

Response	Percentage of Mines	95% CI
Mine has own rescue team	30.6	(18.1, 43.2)
Average number of rescue team members	24.1	(17.1, 31.1)
Frequency of team training		
Less than once a year	0.0	NA
Annually	DSU	DSU
Less than once a month	DSU	DSU
Once a month	67.4	(44.1, 90.7)
Once every 2 weeks	DSU	DSU
Once a week	DSU	DSU
Other time interval	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Mine Statistics for Nonmetal Mines

Summary of Mine Statistics for Nonmetal Mines

The data for training and non-English languages can be found in Tables 121–124. For the U.S. nonmetal mining industry, the weighted survey estimates indicate that more training is conducted by the mine's employees including: annual refresher training (73.2 percent); newly hired inexperienced miner training (59.8 percent); and newly hired experienced miner training (46.3 percent) when compared to the mine's use of outside trainers. Lectures (93.5 percent), written materials (87.5 percent) and videos (77.4 percent) are the top three methods and materials used for training. Estimates from the survey indicate that 34.0 percent of all nonmetal mines have employee safety meetings once a month. Overall, approximately nine percent of nonmetal mine employees use a language other than English.

Tables 125 and 126 present the national estimates for work schedules and shift work. The average number of hours worked per week is 36.3 for production workers, 37.8 for production support workers, and 40.3 for preparation plant/mill workers. The majority of nonmetal mines operate one shift per day (71.3 percent for production workers, 69.7 percent for production support workers, and 34.6 percent for preparation plant/mill workers).

National estimates for independent contractor employees are presented in Table 127. During a typical week, nonmetal mines use independent contractor employees for various types of work including: construction or reconstruction of mine facilities (14.7 percent); excavation or earthmoving activities (12.9 percent); material handling (12.6 percent); and mineral extraction (8.5 percent).

Tables 128–131 present national estimates for safety, communication, and rescue measures. Cell phones (80.9 percent) are the most frequently used communication system followed by hand-held two-way radios (69.3 percent), and dedicated telephones (42.7 percent). Forty-six percent of nonmetal mines use telephones for emergency early warnings. Twelve percent of nonmetal mines report having their own mine rescue team composed of approximately 11 team members. The majority of mine rescue teams train on an annual basis (50.8 percent).

Table 121. Miner Training Within the Past 12 Months at Nonmetal Mines

Training Conducted by	Percentage of Mines	95% CI
Mine employees		
Annual miner refresher	73.2	(63.7, 82.6)
Newly hired inexperienced miner	59.8	(48.3, 71.3)
Newly hired experienced miner	46.3	(37.2, 55.5)
Outside trainer		
Annual miner refresher	46.8	(37.8, 55.9)
Newly hired inexperienced miner	14.2	(9.8, 18.6)
Newly hired experienced miner	10.6	(6.9, 14.3)
Outside contract trainer		
Annual miner refresher	29.9	(17.2, 42.7)
Newly hired inexperienced miner	44.4	(21.1, 67.7)
Newly hired experienced miner	36.7	(5.6, 67.9)
Outside state grantee		
Annual miner refresher	63.7	(51.2, 76.2)
Newly hired inexperienced miner	64.6	(43.7, 85.5)
Newly hired experienced miner	50.9	(30.3, 71.6)
Outside other trainer		
Annual miner refresher	13.4	(4.9, 22.0)
Newly hired inexperienced miner	0.0	NA
Newly hired experienced miner	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 122. Frequency of Periodic Safety Meetings at Nonmetal Mines

Response	Percentage of Mines	95% CI
Less than once a year	DSU	DSU
Annually	DSU	DSU
Less than once a month	6.9	(3.2, 10.7)
Once a month	34.0	(23.2, 44.7)
Once every 2 weeks	4.4	(0.8, 8.1)
Once a week	24.9	(16.1, 33.7)
Several times a week	8.0	(3.3, 12.8)
Daily	16.2	(8.5, 24.0)

Abbreviation: DSU, data suppressed. Notes: Data are national estimates.

Table 123. Employee Safety Training Materials and Methods at Nonmetal Mines

Response	Percentage of Mines	95% CI
Lectures	93.5	(90.1, 96.8)
Written materials	87.5	(81.7, 93.3)
Videos	77.4	(68.4, 86.4)
Self-guided interactive computer programs	13.8	(7.1, 20.6)
Demonstrations	62.9	(50.9, 74.9)
Hands-on training exercises	62.1	(55.9, 68.3)
Group exercises (role playing, games, problem solving)	30.4	(21.6, 39.2)
Classroom simulations (e.g., virtual reality)	12.9	(6.9, 18.9)
Worksite simulations	33.9	(24.6, 43.3)
Narrative storytelling	39.4	(30.0, 48.7)
Other	5.1	(0.6, 9.6)

Notes: Data are national estimates; multiple responses permitted.

Table 124. Non-English Languages at Nonmetal Mines

Response	Percentage	95% CI
Employees use a language other than English to communicate	9.3	(4.9, 13.6)
Mining operations provide training materials, signs, or written materials, in language(s) other than English	22.1	(11.9, 32.2)
Which Language(s) are provided[1]		
Spanish	100.0	NA
Other	DSU	DSU
Helpful to have training materials, signs, or written materials in other languages, in addition to those already provided	17.9	(4.7, 31.1)
Helpful to have training materials, signs, or written materials in language(s) other than English	9.7	(4.1, 15.3)

[1]Multiple responses permitted. Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates;

Table 125. Work Schedules at Nonmetal Mines

Response	Production Workers	95% CI	Production Support Workers	95% CI	Preparation Plant/Mill Workers	95% CI
Scheduled days per week (average)	4.7	(4.5, 5.0)	4.9	(4.7, 5.1)	4.8	(4.5, 5.0)
Scheduled hours per day (average)	8.9	(8.6, 9.2)	8.5	(8.2, 8.7)	9.4	(8.3, 10.4)
Actual hours worked per week (average)	36.3	(33.2, 39.4)	37.8	(35.9, 39.7)	40.3	(37.5, 43.1)
Work crews change shifts at active mining site (percentage)	9.9	(4.3, 15.5)	13.0	(4.7, 21.4)	NA	NA
Average time spent traveling to and from active mining site while being paid (hours)	1.7	(1.6, 1.8)	1.7	(1.5, 1.8)	NA	NA

Abbreviation: NA, not applicable. Note: Data are national estimates.

Table 126. Shift Work Schedules at Nonmetal Mines

Response	Production Workers Percentage of Mines	95% CI	Production Support Workers Percentage of Mines	95% CI	Preparation Plant/Mill Workers Percentage of Mines	95% CI
Number of shifts per day						
1 shift	71.3	(62.8, 79.8)	69.7	(59.1, 80.2)	34.6	(21.4, 47.7)
2 shifts	17.6	(10.6, 24.5)	12.9	(6.6, 19.2)	30.7	(17.6, 43.7)
3 shifts	10.2	(4.8, 15.5)	16.5	(9.3, 23.7)	33.4	(23.0, 43.7)
4 shifts	DSU	DSU	DSU	DSU	DSU	DSU
Rotating shifts	15.1	(8.1, 22.1)	17.7	(7.5, 28.0)	36.8	(25.3, 48.2)
Frequency workers rotate shifts						
Weekly	45.3	(25.6, 65.0)	65.0	(45.8, 84.3)	65.4	(49.5, 81.4)
Twice a month	37.7	(16.4, 59.0)	DSU	DSU	23.4	(8.2, 38.5)
Monthly	DSU	DSU	0.0	NA	DSU	DSU
Other	DSU	DSU	DSU	DSU	DSU	DSU
Direction the shift rotates						
Clockwise (day—afternoon—night)	68.6	(49.2, 87.9)	60.2	(37.2, 83.1)	58.4	(37.5, 79.4)
Counterclockwise (night—afternoon—day)	DSU	DSU	29.1	(7.0, 51.3)	24.1	(4.9, 43.2)
Other	DSU	DSU	DSU	DSU	17.5	(4.0, 31.0)
Unique work shifts	8.6	(4.2, 13.0)	8.1	(2.5, 13.8)	16.7	(8.8, 24.6)

Abbreviations: DSU, data suppressed; NA, not applicable. Notes: Data are national estimates.

Table 127. Activities of Independent Contractor Employees During the Reporting Week at Nonmetal Mines

Response	Percentage of Mines Reporting Contractors	95% CI	Average Number of Contractor employees	95% CI	Average Total Hours	95% CI
Mine development	DSU	DSU	DSU	DSU	DSU	DSU
Construction or reconstruction of mine facilities	14.7	(8.6, 20.8)	3.5	(2.0, 5.0)	100.4	(43.9, 157.0)
Demolition of mine facilities	0.0	NA	NA	NA	NA	NA
Construction of dams	0.0	NA	NA	NA	NA	NA
Excavation or earthmoving activities (involving mobile equipment)	12.9	(5.6, 20.1)	13.5	(3.8, 23.3)	490.4	(189.0, 791.8)
Equipment installation	5.5	(2.1, 9.0)	3.2	(2.6, 3.8)	126.5	(67.0, 185.9)
Equipment service or repair of equipment on mine property (exceeding 5 consecutive days)	7.1	(3.6, 10.6)	6.9	(1.6, 12.1)	254.2	(68.1, 440.2)
Material handling (within mine property)	12.6	(7.7, 17.5)	7.9	(3.4, 12.4)	302.0	(92.5, 511.6)
Drilling and blasting	7.6	(2.7, 12.6)	6.0	(0.7, 11.3)	47.7	(7.0, 88.3)
Production support work	2.8	(0.8, 4.7)	2.9	(0.6, 5.3)	47.6	(0.0, 100.4)
Mineral extraction	8.5	(3.3, 13.7)	3.3	(2.3, 4.2)	100.9	(50.7, 151.2)
Other work	DSU	DSU	DSU	DSU	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable. Notes: Data are national estimates.

Table 128. Communication Devices and Systems at Nonmetal Mines

Response	Percentage of Mines	95% CI
Dedicated telephones	42.7	(31.8, 53.7)
Mine page phones	10.2	(6.1, 14.3)
Trolley phones	0.0	NA
Shaft or hoist phones	3.0	(1.8, 4.2)
Cell phones	80.9	(72.2, 89.7)
Voice over internet protocol (VOIP) phones	1.8	(0.3, 3.4)
Hand-held two-way radios	69.3	(61.9, 76.6)
Wireless paging devices	6.1	(2.0, 10.2)
Leaky feeder communications system (not running a PED)	1.5	(0.2, 2.8)
Personal emergency device (PED) cap lamp/pager	DSU	DSU
Through-the-Earth (TTE) technology (other than a PED)	0.0	NA
Inductive coupled radios	DSU	DSU
Ethernet	7.3	(1.9, 12.6)
TRACKER tagging system	DSU	DSU
Longwall face communication systems	NA	NA
None of the above	DSU	DSU
Other	7.5	(2.4, 12.6)

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 129. Personal Locators, Trackers, and Devices at Nonmetal Mines

Response	Percentage of Mines	95% CI
Electronic or computerized tagging or tracking	DSU	DSU
Tag boards	6.9	(5.0, 8.8)
Reflective vests/clothing	25.6	(18.4, 32.7)
Chemical light sticks	0.0	NA
Lighted vests	0.0	NA
Laser lights/pointers	0.0	NA
Strobe lights	8.0	(2.5, 13.5)
None of the above	63.8	(55.0, 72.5)
Other	6.1	(1.5, 10.7)

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 130. Emergency Early Warning Methods at Nonmetal Mines

Response	Percentage of Mines	95% CI
Stench gas	DSU	DSU
Audible systems	32.9	(23.1, 42.6)
Visual systems	13.4	(8.7, 18.1)
Pager phones	10.0	(4.7, 15.3)
Telephones	45.6	(33.8, 57.5)
Messengers	14.1	(7.5, 20.8)
Electronic personal communication systems	DSU	DSU
None of the above	28.9	(20.8, 37.0)
Other	11.1	(6.6, 15.7)

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 131. Rescue Teams at Nonmetal Mines

Response	Percentage of Mines	95% CI
Mine has own rescue team	12.1	(7.7, 16.5)
Average number of rescue team members	11.2	(6.2, 16.2)
Frequency of team training		
Less than once a year	0.0	NA
Annually	50.8	(28.4, 73.3)
Less than once a month	DSU	DSU
Once a month	40.4	(20.7, 60.1)
Once every 2 weeks	0.0	NA
Once a week	0.0	NA
Other time interval	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable. Notes: Data are national estimates.

Mine Statistics for Underground Nonmetal Mines

Summary Mine Statistics for Underground Nonmetal Mines

The data for training and non-English languages can be found in Tables 132–135. For underground nonmetal mines, the weighted survey estimates indicate that more training is conducted by the mine's employees for annual refresher training (82.2 percent), when compared to the mine's use of outside trainers. No comparisons are possible for newly hired inexperienced and experienced miner training due to the need to suppress data (i.e., the survey count was less than five responses). Lectures (100.0 percent), written materials (90.8 percent), and demonstrations (85.3 percent) are the top three methods and materials used for training. Estimates from the survey indicate that 33.3 percent of underground nonmetal mines have daily safety meetings. Approximately four percent of underground nonmetal mine employees use a language other than English.

Tables 136 and 137 present the national estimates for work schedules and shift work. The average number of hours worked per week is 34.1 for production workers, 36.8 for production support workers, and 35.4 for preparation plant/mill workers. The majority of underground nonmetal mines operate two shifts per day for production workers (38.6 percent), one shift per day for production support workers (52.7 percent), and three shifts per day for preparation plant/mill workers (48.4 percent).

National estimates for independent contractor employees are presented in Table 138. During a typical week, underground nonmetal mines use independent contractor employees for various types of work including: construction or reconstruction of mine facilities (33.6 percent) and equipment service or repair of equipment on mine property (23.3 percent). Most of the other data in this table have been suppressed due to a survey count of less than five responses.

Tables 139–144 present national estimates for safety, communication, and rescue measures. Hand-held two-way radios (76.9 percent) are the most frequently used communication system followed by mine page phones (72.2 percent) and dedicated telephones (71.7 percent). Tag boards (95.3 percent) and reflective vests/clothing (43.1 percent) are the most frequently used personal locators/trackers in underground nonmetal mines. Colored reflectors (76.1 percent) and signage (75.6 percent) are the most frequently reported escape aids. First aid kits (95.3 percent), defibrillators (67.8 percent), and filter self-rescuers (66.4 percent) are the top three emergency equipment and supplies found in these mines. Seventy-two percent of underground nonmetal mines use visual systems for emergency early warnings. Approximately 67 percent of underground nonmetal mines report having their own mine rescue team composed of 10 team members. The majority of mine rescue teams train once a month (92.5 percent).

Table 132. Miner Training Within the Past 12 Months at Underground Nonmetal Mines

Training Conducted by	Percentage of Mines	95% CI
Mine employees		
Annual miner refresher	82.2	(68.8, 95.6)
Newly hired inexperienced miner	81.4	(64.7, 98.1)
Newly hired experienced miner	58.0	(37.4, 78.7)
Outside trainer		
Annual miner refresher	37.0	(17.1, 56.9)
Newly hired inexperienced miner	DSU	DSU
Newly hired experienced miner	DSU	DSU
Outside contract trainer		
Annual miner refresher	DSU	DSU
Newly hired inexperienced miner	DSU	DSU
Newly hired experienced miner	DSU	DSU
Outside state grantee		
Annual miner refresher	73.0	(48.4, 97.5)
Newly hired inexperienced miner	DSU	DSU
Newly hired experienced miner	DSU	DSU
Outside other trainer		
Annual miner refresher	DSU	DSU
Newly hired inexperienced miner	DSU	DSU
Newly hired experienced miner	DSU	DSU

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 133. Frequency of Periodic Safety Meetings at Underground Nonmetal Mines

Response	Percentage of Mines	95% CI
Less than once a year	0.0	NA
Annually	0.0	NA
Less than once a month	DSU	DSU
Once a month	DSU	DSU
Once every 2 weeks	DSU	DSU
Once a week	23.6	(3.8, 43.4)
Several times a week	DSU	DSU
Daily	33.3	(13.7, 53.0)

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 134. Employee Safety Training Materials and Methods at Underground Nonmetal Mines

Response	Percentage of Mines	95% CI
Lectures	100.0	NA
Written materials	90.8	(80.7, 100.0)
Videos	76.1	(56.4, 95.8)
Self-guided interactive computer programs	DSU	DSU
Demonstrations	85.3	(71.7, 98.9)
Hands-on training exercises	81.1	(66.0, 96.2)
Group exercises (role playing, games, problem solving)	38.1	(15.0, 61.1)
Classroom simulations (e.g., virtual reality)	DSU	DSU
Worksite simulations	38.6	(20.0, 57.2)
Narrative storytelling	38.9	(20.2, 57.6)
Other	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 135. Non-English Languages at Underground Nonmetal Mines

Response	Percentage	95% CI
Employees use a language other than English to communicate	4.1	(0.0, 11.1)
Mining operations provide training materials, signs, or written materials, in language(s) other than English	DSU	DSU
Which Language(s) are provided[1]		
Spanish	DSU	DSU
Other	DSU	DSU
Helpful to have training materials, signs, or written materials in other languages, in addition to those already provided	DSU	DSU
Helpful to have training materials, signs, or written materials in language(s) other than English	DSU	DSU

[1]Multiple responses permitted. Abbreviation: DSU, data suppressed.

Note: Data are national estimates.

Table 136. Work Schedules at Underground Nonmetal Mines

Response	Production Workers	95% CI	Production Support Workers	95% CI	Preparation Plant/Mill Workers	95% CI
Scheduled days per week (average)	4.8	(4.3, 5.2)	5.1	(4.9, 5.3)	4.8	(4.2, 5.4)
Scheduled hours per day (average)	8.5	(7.7, 9.3)	8.8	(8.4, 9.2)	8.9	(8.2, 9.6)
Actual hours worked per week (average)	34.1	(26.0, 42.1)	36.8	(27.5, 46.0)	35.4	(26.8, 44.0)
Work crews change shifts at active mining site (percentage)	DSU	DSU	DSU	DSU	NA	NA
Average time spent traveling to and from active mining site while being paid (hours)	1.8	(1.6, 2.0)	1.7	(1.4, 2.0)	NA	NA

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 137. Shift Work Schedules at Underground Nonmetal Mines

Response	Production Workers Percentage of Mines	95% CI	Production Support Workers Percentage of Mines	95% CI	Preparation Plant/Mill Workers Percentage of Mines	95% CI
Number of shifts per day						
1 shift	36.4	(16.4, 56.4)	52.7	(26.2, 79.3)	DSU	DSU
2 shifts	38.6	(17.7, 59.5)	28.8	(8.3, 49.2)	34.8	(11.9, 57.7)
3 shifts	25.0	(6.5, 43.5)	DSU	DSU	48.4	(24.4, 72.5)
4 shifts	0.0	NA	0.0	NA	0.0	NA
Rotating shifts	25.0	(7.6, 42.4)	DSU	DSU	30.7	(10.7, 50.7)
Frequency workers rotate shifts						
Weekly	DSU	DSU	DSU	DSU	100.0	NA
Twice a month	DSU	DSU	DSU	DSU	0.0	NA
Monthly	0.0	NA	DSU	DSU	0.0	NA
Other	0.0	NA	DSU	DSU	0.0	NA
Direction the shift rotates						
Clockwise (day—afternoon—night)	DSU	DSU	DSU	DSU	DSU	DSU
Counterclockwise (night—afternoon—day)	DSU	DSU	DSU	DSU	DSU	DSU
Other	DSU	DSU	DSU	DSU	DSU	DSU
Unique work shifts	DSU	DSU	DSU	DSU	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 138. Activities of Independent Contractor Employees During the Reporting Week at Underground Nonmetal Mines

Response	Percentage of Mines Reporting Contractors	95% CI	Average Number of Contractor Employees	95% CI	Average Total Hours	95% CI
Mine development	DSU	DSU	DSU	DSU	DSU	DSU
Construction or reconstruction of mine facilities	33.6	(14.1, 53.1)	6.1	(2.6, 9.6)	171.6	(74.3, 268.8)
Demolition of mine facilities	0.0	NA	NA	NA	NA	NA
Construction of dams	0.0	NA	NA	NA	NA	NA
Excavation or earthmoving activities (involving mobile equipment)	0.0	NA	NA	NA	NA	NA
Equipment installation	DSU	DSU	DSU	DSU	DSU	DSU
Equipment service or repair of equipment on mine property (exceeding 5 consecutive days)	23.3	(10.2, 36.4)	3.4	(1.7, 5.0)	99.0	(40.2, 157.9)
Material handling (within mine property)	DSU	DSU	DSU	DSU	DSU	DSU
Drilling and blasting	DSU	DSU	DSU	DSU	DSU	DSU
Production support work	DSU	DSU	DSU	DSU	DSU	DSU
Mineral extraction	DSU	DSU	DSU	DSU	DSU	DSU
Other work	DSU	DSU	DSU	DSU	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 139. Communication Devices and Systems at Underground Nonmetal Mines

Response	Percentage of Mines	95% CI
Dedicated telephones	71.7	(51.2, 92.1)
Mine page phones	72.2	(53.7, 90.7)
Trolley phones	0.0	NA
Shaft or hoist phones	47.8	(26.0, 69.6)
Cell phones	56.7	(38.8, 74.6)
Voice over internet protocol (VOIP) phones	DSU	DSU
Hand-held two-way radios	76.9	(62.4, 91.5)
Wireless paging devices	0.0	NA
Leaky feeder communications system (not running a PED)	24.4	(2.7, 46.2)
Personal emergency device (PED) cap lamp/pager	DSU	DSU
Through-the-Earth (TTE) technology (other than a PED)	0.0	NA
Inductive coupled radios	DSU	DSU
Ethernet	DSU	DSU
TRACKER tagging system	DSU	DSU
Longwall face communication systems	NA	NA
None of the above	0.0	NA
Other	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 140. Personal Locators, Trackers, and Devices at Underground Nonmetal Mines

Response	Percentage of Mines	95% CI
Electronic or computerized tagging or tracking	DSU	DSU
Tag boards	95.3	(89.0, 100.0)
Reflective vests/clothing	43.1	(20.9, 65.2)
Chemical light sticks	0.0	NA
Lighted vests	0.0	NA
Laser lights/pointers	0.0	NA
Strobe lights	DSU	DSU
None of the above	0.0	NA
Other	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 141. Emergency Early Warning Methods at Underground Nonmetal Mines

Response	Percentage of Mines	95% CI
Stench gas	DSU	DSU
Audible systems	42.5	(22.1, 62.9)
Visual systems	71.7	(51.8, 91.6)
Pager phones	48.3	(27.5, 69.2)
Telephones	57.0	(35.0, 78.9)
Messengers	23.3	(6.1, 40.6)
Electronic personal communication systems	DSU	DSU
None of the above	DSU	DSU
Other	DSU	DSU

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 142. Rescue Teams at Underground Nonmetal Mines

Response	Percentage of Mines	95% CI
Mine has own rescue team	66.7	(45.5, 87.8)
Average number of rescue team members	9.9	(7.7, 12.2)
Frequency of team training		
Less than once a year	0.0	NA
Annually	0.0	NA
Less than once a month	DSU	DSU
Once a month	92.5	(79.3, 100.0)
Once every 2 weeks	0.0	NA
Once a week	0.0	NA
Other time interval	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 143. Emergency Equipment and Supplies at Underground Nonmetal Mines

Response	Percentage of Mines	95% CI
Belt-worn self-contained self-rescuers (SCSRs)	38.3	(17.5, 59.1)
Cached self-contained self-rescuers (SCSRs)	DSU	DSU
Filter self-rescuers (FSRs)	66.4	(48.3, 84.5)
Stationary emergency refuge chambers	24.7	(6.3, 43.1)
Mobile emergency refuge chambers	0.0	NA
Sealing materials	24.4	(2.9, 46.0)
Cached water/food supplies	34.2	(15.2, 53.1)
First aid kits	95.3	(86.4, 100.0)
Defibrillator	67.8	(43.5, 92.0)
None of the above	0.0	NA
Other	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 144. Escape Aids at Underground Nonmetal Mines

Response	Percentage of Mines	95% CI
Lifelines	DSU	DSU
Directional lifelines	0.0	NA
Signage	75.6	(59.8, 91.3)
Colored reflectors	76.1	(55.5, 96.8)
Lighting	37.5	(16.7, 58.3)
Strobe lights	DSU	DSU
None of the above	0.0	NA
Other	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Mine Statistics for Surface Nonmetal Mines

Summary of Mine Statistics for Surface Nonmetal Mines

The data for training and non-English languages can be found in Tables 145–148. For surface nonmetal mines, the weighted survey estimates indicate that more training is conducted by the mine's employees including: annual refresher training (72.6 percent), newly hired inexperienced miner training (58.4 percent), and newly hired experienced miner training (45.5 percent) when compared to the mine's use of outside trainers. Lectures (93.1 percent), written materials (87.3 percent), and videos (77.5 percent) are the top three methods and materials used for training. Estimates from the survey indicate that 35.0 percent of surface nonmetal mines have employee safety meetings once a month. Approximately 10 percent of surface nonmetal mine employees use a language other than English.

Tables 149 and 150 present the national estimates for work schedules and shift work. The average number of hours worked per week is 36.5 for production workers, 37.9 for production support workers, and 40.9 for preparation plant/mill workers. The majority of surface nonmetal mines operate one shift per day (74.7 percent for production workers, 70.9 percent for production support workers, and 36.6 percent for preparation plant/mill workers).

National estimates for independent contractor employees are presented in Table 151. During a typical week, surface nonmetal mines use independent contractor employees for various types of work including: excavation or earthmoving activities (13.7 percent), construction or reconstruction of mine facilities (13.4 percent), material handling (12.8 percent), and mineral extraction (8.1 percent).

Tables 152–155 present national estimates for safety, communication, and rescue measures. Cell phones (82.6 percent) are the most frequently used communication system followed by hand-held two-way radios (68.7 percent), and dedicated telephones (40.8 percent). Forty-five percent of surface nonmetal mines use telephones for emergency early warnings. Approximately nine percent of surface nonmetal mines report having their own mine rescue team composed of about 12 team members. The majority of mine rescue teams train on an annual basis (81.9 percent).

Table 145. Miner Training Within the Past 12 Months at Surface Nonmetal Mines

Training Conducted by	Percentage of Mines	95% CI
Mine employees		
Annual miner refresher	72.6	(62.5, 82.6)
Newly hired inexperienced miner	58.4	(46.2, 70.5)
Newly hired experienced miner	45.5	(35.9, 55.2)
Outside trainer		
Annual miner refresher	47.5	(38.0, 57.0)
Newly hired inexperienced miner	13.9	(9.2, 18.5)
Newly hired experienced miner	10.4	(6.6, 14.2)
Outside contract trainer		
Annual miner refresher	30.8	(17.4, 44.1)
Newly hired inexperienced miner	46.0	(21.0, 71.0)
Newly hired experienced miner	DSU	DSU
Outside state grantee		
Annual miner refresher	63.2	(50.1, 76.3)
Newly hired inexperienced miner	63.8	(41.5, 86.2)
Newly hired experienced miner	52.7	(30.5, 74.9)
Outside other trainer		
Annual miner refresher	13.4	(4.5, 22.4)
Newly hired inexperienced miner	0.0	NA
Newly hired experienced miner	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 146. Frequency of Periodic Safety Meetings at Surface Nonmetal Mines

Response	Percentage of Mines	95% CI
Less than once a year	DSU	DSU
Annually	DSU	DSU
Less than once a month	7.1	(3.2, 11.0)
Once a month	35.0	(23.5, 46.5)
Once every 2 weeks	4.4	(0.6, 8.2)
Once a week	25.0	(15.7, 34.2)
Several times a week	7.5	(2.6, 12.5)
Daily	15.1	(6.9, 23.3)

Abbreviation: DSU, data suppressed. Note: Data are national estimates.

Table 147. Employee Safety Training Materials and Methods at Surface Nonmetal Mines

Response	Percentage of Mines	95% CI
Lectures	93.1	(89.5, 96.6)
Written materials	87.3	(81.2, 93.5)
Videos	77.5	(67.9, 87.0)
Self-guided interactive computer programs	13.8	(6.7, 20.9)
Demonstrations	61.4	(48.7, 74.2)
Hands-on training exercises	60.8	(54.3, 67.4)
Group exercises (role playing, games, problem solving)	29.9	(20.7, 39.1)
Classroom simulations (e.g., virtual reality)	12.5	(6.2, 18.8)
Worksite simulations	33.6	(23.7, 43.6)
Narrative storytelling	39.4	(29.5, 49.3)
Other	5.5	(0.7, 10.2)

Notes: Data are national estimates; multiple responses permitted.

Table 148. Non-English Languages at Surface Nonmetal Mines

Response	Percentage	95% CI
Employees use a language other than English to communicate	9.6	(4.9, 14.3)
Mining operations provide training materials, signs, or written materials, in language(s) other than English	22.6	(11.8, 33.3)
Which Language(s) are provided[1]		
Spanish	100.0	NA
Other	DSU	DSU
Helpful to have training materials, signs, or written materials in other languages, in addition to those already provided	17.2	(3.7, 30.7)
Helpful to have training materials, signs, or written materials in language(s) other than English	10.0	(4.1, 15.9)

[1]Multiple responses permitted. Abbreviations: DSU, data suppressed; NA, not applicable.

Note: Data are national estimates.

Table 149. Work Schedules at Surface Nonmetal Mines

Response	Production Workers	95% CI	Production Support Workers	95% CI	Preparation Plant/Mill Workers	95% CI
Scheduled days per week (average)	4.7	(4.4, 5.0)	4.9	(4.7, 5.1)	4.8	(4.5, 5.0)
Scheduled hours per day (average)	8.9	(8.6, 9.2)	8.5	(8.2, 8.7)	9.4	(8.3, 10.6)
Actual hours worked per week (average)	36.5	(33.2, 39.8)	37.9	(36.0, 39.8)	40.9	(37.9, 43.8)
Work crews change shifts at active mining site (percentage)	9.4	(3.4, 15.3)	13.6	(4.6, 22.5)	NA	NA
Average time spent traveling to and from active mining site while being paid (hours)	1.7	(1.6, 1.8)	1.7	(1.5, 1.8)	NA	NA

Abbreviation: NA, not applicable. Note: Data are national estimates.

Table 150. Shift Work Schedules at Surface Nonmetal Mines

	Production Workers		Production Support Workers		Preparation Plant/Mill Workers	
Response	**Percentage of Mines**	**95% CI**	**Percentage of Mines**	**95% CI**	**Percentage of Mines**	**95% CI**
Number of shifts per day						
1 shift	74.7	(65.5, 83.8)	70.9	(59.9, 82.0)	36.6	(22.2, 50.9)
2 shifts	15.6	(8.2, 22.9)	11.7	(5.1, 18.3)	30.2	(16.0, 44.4)
3 shifts	8.7	(3.1, 14.4)	16.4	(8.7, 24.0)	31.7	(20.5, 42.8)
4 shifts	DSU	DSU	DSU	DSU	DSU	DSU
Rotating shifts	14.2	(6.7, 21.7)	18.6	(7.6, 29.6)	37.4	(24.9, 50.0)
Frequency workers rotate shifts						
Weekly	39.4	(18.3, 60.6)	64.2	(44.5, 83.8)	62.3	(45.1, 79.6)
Twice a month	40.7	(16.8, 64.6)	DSU	DSU	25.5	(9.0, 42.0)
Monthly	DSU	DSU	0.0	NA	DSU	DSU
Other	DSU	DSU	DSU	DSU	DSU	DSU
Direction the shift rotates						
Clockwise (day—afternoon—night)	73.4	(52.8, 94.0)	61.7	(38.5, 84.8)	60.1	(37.7, 82.5)
Counterclockwise (night—afternoon—day)	DSU	DSU	27.4	(5.2, 49.5)	22.6	(2.2, 43.0)
Other	DSU	DSU	DSU	DSU	17.3	(2.8, 31.7)
Unique work shifts	8.0	(3.4, 12.6)	7.8	(1.9, 13.8)	16.6	(8.0, 25.1)

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 151. Activities of Independent Contractor Employees During the Reporting Week at Surface Nonmetal Mines

Response	Percentage of Mines Reporting Contractors	95% CI	Average Number of Contractor Employees	95% CI	Average Total Hours	95% CI
Mine development	DSU	DSU	DSU	DSU	DSU	DSU
Construction or reconstruction of mine facilities	13.4	(7.1, 19.8)	3.1	(1.5, 4.7)	88.7	(25.8, 151.7)
Demolition of mine facilities	0.0	NA	NA	NA	NA	NA
Construction of dams	0.0	NA	NA	NA	NA	NA
Excavation or earthmoving activities (involving mobile equipment)	13.7	(5.9, 21.4)	13.5	(3.8, 23.3)	490.4	(189.0, 791.8)
Equipment installation	5.3	(1.7, 8.8)	3.2	(2.6, 3.9)	135.5	(70.3, 200.6)
Equipment service or repair of equipment on mine property (exceeding 5 consecutive days)	6.0	(2.4, 9.7)	7.8	(1.1, 14.4)	293.6	(58.4, 528.8)
Material handling (within mine property)	12.8	(7.6, 18.0)	8.2	(3.5, 12.8)	313.9	(95.1, 532.8)
Drilling and blasting	7.5	(2.3, 12.7)	6.3	(0.5, 12.0)	50.7	(6.3, 95.1)
Production support work	DSU	DSU	DSU	DSU	DSU	DSU
Mineral extraction	8.1	(2.7, 13.6)	3.3	(2.2, 4.4)	109.7	(56.7, 162.8)
Other work	DSU	DSU	DSU	DSU	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 152. Communication Devices and Systems at Surface Nonmetal Mines

Response	Percentage of Mines	95% CI
Dedicated telephones	40.8	(29.3, 52.3)
Mine page phones	6.0	(2.0, 10.0)
Trolley phones	0.0	NA
Shaft or hoist phones	NA	NA
Cell phones	82.6	(73.3, 91.8)
Voice over internet protocol (VOIP) phones	DSU	DSU
Hand-held two-way radios	68.7	(61.0, 76.5)
Wireless paging devices	6.5	(2.1, 10.9)
Leaky feeder communications system (not running a PED)	0.0	NA
Personal emergency device (PED) cap lamp/pager	DSU	DSU
Through-the-Earth (TTE) technology (other than a PED)	0.0	NA
Inductive coupled radios	0.0	NA
Ethernet	7.1	(1.4, 12.8)
TRACKER tagging system	0.0	NA
Longwall face communication systems	NA	NA
None of the above	DSU	DSU
Other	8.0	(2.5, 13.5)

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 153. Personal Locators, Trackers, and Devices at Surface Nonmetal Mines

Response	Percentage of Mines	95% CI
Electronic or computerized tagging or tracking	DSU	DSU
Tag boards	DSU	DSU
Reflective vests/clothing	24.3	(16.8, 31.8)
Chemical light sticks	0.0	NA
Lighted vests	0.0	NA
Laser lights/pointers	0.0	NA
Strobe lights	7.5	(1.8, 13.3)
None of the above	68.2	(59.0, 77.4)
Other	6.2	(1.3, 11.1)

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 154. Emergency Early Warning Methods at Surface Nonmetal Mines

Response	Percentage of Mines	95% CI
Stench gas	0.0	NA
Audible systems	32.2	(21.9, 42.5)
Visual systems	9.4	(4.7, 14.2)
Pager phones	7.4	(1.8, 13.1)
Telephones	44.9	(32.4, 57.4)
Messengers	13.5	(6.5, 20.5)
Electronic personal communication systems	DSU	DSU
None of the above	30.5	(22.0, 39.1)
Other	11.6	(6.7, 16.4)

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 155. Rescue Teams at Surface Nonmetal Mines

Response	Percentage of Mines	95% CI
Mine has own rescue team	8.5	(4.0, 13.0)
Average number of rescue team members	11.9	(4.2, 19.5)
Frequency of team training		
Less than once a year	0.0	NA
Annually	81.9	(60.3, 100.0)
Less than once a month	DSU	DSU
Once a month	DSU	DSU
Once every 2 weeks	0.0	NA
Once a week	0.0	NA
Other time interval	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Mine Statistics for Stone Mines

Summary of Mine Statistics for Stone Mines

The data for training and non-English languages can be found in Tables 156–159. For the U.S. stone mining industry, the weighted survey estimates indicate that more training is conducted by the mine's employees including: annual refresher training (75.0 percent); newly hired inexperienced miner training (75.1 percent); and newly hired experienced miner training (66.0 percent) when compared to the mine's use of outside trainers. Lectures (91.1 percent), written materials (88.8 percent) and videos (82.3 percent) are the top three methods and materials used for training. Estimates from the survey indicate that 46.0 percent of all mines have employee safety meetings once a week. Overall, approximately 12 percent of mine employees use a language other than English.

Tables 160 and 161 present the national estimates for work schedules and shift work. The average number of hours worked per week is 40.6 for production workers, 41.5 for production support workers, and 42.5 for preparation plant/mill workers. The majority of stone mines operate one shift per day (81.7 percent for production workers, 86.0 percent for production support workers, and 80.0 percent for preparation plant/mill workers).

National estimates for independent contractor employees are presented in Table 162. During a typical week, stone mines use independent contractor employees for various types of work including: drilling and blasting (25.4 percent); construction or reconstruction of mine facilities (10.5 percent); equipment service or repair of equipment on mine property (8.3 percent); and excavation or earthmoving activities (5.4 percent).

Tables 163–166 present national estimates for safety, communication, and rescue measures. Cell phones (86.0 percent) are the most frequently used communication system followed by hand-held two-way radios (61.8 percent), and dedicated telephones (48.2 percent). Forty-nine percent of stone mines use telephones for emergency early warnings. Eight percent of stone mines report having their own mine rescue team composed of approximately seven team members. The majority of mine rescue teams train on an annual basis (82.7 percent).

Table 156. Miner Training Within the Past 12 Months at Stone Mines

Training Conducted by	Percentage of Mines	95% CI
Mine employees		
Annual miner refresher	75.0	(67.7, 82.2)
Newly hired inexperienced miner	75.1	(68.1, 82.0)
Newly hired experienced miner	66.0	(58.4, 73.7)
Outside trainer		
Annual miner refresher	49.2	(40.0, 58.5)
Newly hired inexperienced miner	18.5	(10.5, 26.5)
Newly hired experienced miner	15.9	(9.0, 22.9)
Outside contract trainer		
Annual miner refresher	59.1	(49.5, 68.6)
Newly hired inexperienced miner	65.3	(41.3, 89.3)
Newly hired experienced miner	77.4	(63.2, 91.5)
Outside state grantee		
Annual miner refresher	29.2	(15.8, 42.6)
Newly hired inexperienced miner	25.0	(0.0, 50.8)
Newly hired experienced miner	16.7	(2.3, 31.1)
Outside other trainer		
Annual miner refresher	11.8	(4.7, 18.9)
Newly hired inexperienced miner	DSU	DSU
Newly hired experienced miner	DSU	DSU

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 157. Frequency of Periodic Safety Meetings at Stone Mines

Response	Percentage of Mines	95% CI
Less than once a year	0.0	NA
Annually	DSU	DSU
Less than once a month	10.7	(7.3, 14.0)
Once a month	17.0	(10.4, 23.6)
Once every 2 weeks	6.8	(2.7, 11.0)
Once a week	46.0	(33.9, 58.1)
Several times a week	5.9	(2.6, 9.1)
Daily	12.0	(3.1, 20.8)

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 158. Employee Safety Training Materials and Methods at Stone Mines

Response	Percentage of Mines	95% CI
Lectures	91.1	(85.7, 96.5)
Written materials	88.8	(80.4, 97.2)
Videos	82.3	(76.2, 88.4)
Self-guided interactive computer programs	16.7	(10.7, 22.6)
Demonstrations	71.7	(61.4, 81.9)
Hands-on training exercises	66.1	(59.9, 72.3)
Group exercises (role playing, games, problem solving)	39.5	(32.5, 46.6)
Classroom simulations (e.g., virtual reality)	7.8	(4.0, 11.6)
Worksite simulations	31.9	(25.5, 38.3)
Narrative storytelling	54.2	(46.3, 62.1)
Other	3.6	(1.1, 6.0)

Notes: Data are national estimates; multiple responses permitted.

Table 159. Non-English Languages at Stone Mines

Response	Percentage	95% CI
Employees use a language other than English to communicate	11.8	(5.6, 18.1)
Mining operations provide training materials, signs, or written materials, in language(s) other than English	32.9	(22.8, 43.0)
Which Language(s) are provided[1]		
Spanish	100.0	NA
Other	DSU	DSU
Helpful to have training materials, signs, or written materials in other languages, in addition to those already provided	36.0	(16.6, 55.4)
Helpful to have training materials, signs, or written materials in language(s) other than English	13.1	(6.7, 19.4)

[1]Multiple responses permitted. Abbreviations: DSU, data suppressed; NA, not applicable.

Note: Data are national estimates.

Table 160. Work Schedules at Stone Mines

Response	Production Workers	95% CI	Production Support Workers	95% CI	Preparation Plant/Mill Workers	95% CI
Scheduled days per week (average)	4.9	(4.9, 5.0)	5.0	(5.0, 5.1)	4.9	(4.8, 5.1)
Scheduled hours per day (average)	9.0	(8.8, 9.3)	10.3	(8.6, 12.0)	9.1	(8.7, 9.5)
Actual hours worked per week (average)	40.6	(38.7, 42.6)	41.5	(38.3, 44.6)	42.5	(38.9, 46.1)
Work crews change shifts at active mining site (percentage)	8.3	(5.1, 11.4)	5.6	(1.7, 9.5)	NA	NA
Average time spent traveling to and from active mining site while being paid (hours)	1.5	(1.3, 1.6)	1.5	(1.4, 1.7)	NA	NA

Abbreviation: NA, not applicable. Note: Data are national estimates.

Table 161. Shift Work Schedules at Stone Mines

	Production Workers		Production Support Workers		Preparation Plant/Mill Workers	
Response	**Percentage of Mines**	**95% CI**	**Percentage of Mines**	**95% CI**	**Percentage of Mines**	**95% CI**
Number of shifts per day						
1 shift	81.7	(76.9, 86.5)	86.0	(79.7, 92.3)	80.0	(74.3, 85.8)
2 shifts	15.9	(10.7, 21.1)	10.6	(4.4, 16.8)	13.1	(6.9, 19.2)
3 shifts	2.3	(0.3, 4.2)	3.4	(1.8, 5.0)	5.2	(3.1, 7.2)
4 shifts	DSU	DSU	0.0	NA	DSU	DSU
Rotating shifts	3.3	(0.8, 5.9)	2.5	(1.2, 3.8)	4.0	(2.1, 5.9)
Frequency workers rotate shifts						
Weekly	90.3	(78.7, 100.0)	83.8	(63.1, 100.0)	70.9	(44.0, 97.9)
Twice a month	DSU	DSU	DSU	DSU	0.0	NA
Monthly	0.0	NA	DSU	DSU	DSU	DSU
Other	0.0	NA	0.0	NA	DSU	DSU
Direction the shift rotates						
Clockwise (day—afternoon—night)	78.1	(58.8, 97.4)	67.8	(42.2, 93.4)	83.5	(63.3, 100.0)
Counterclockwise (night—afternoon—day)	DSU	DSU	DSU	DSU	DSU	DSU
Other	DSU	DSU	DSU	DSU	DSU	DSU
Unique work shifts	1.6	(0.5, 2.7)	0.9	(0.1, 1.8)	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 162. Activities of Independent Contractor Employees During the Reporting Week at Stone Mines

Response	Percentage of Mines Reporting Contractors	95% CI	Average Number of Contractor Employees	95% CI	Average Total Hours	95% CI
Mine development	3.0	(0.2, 5.8)	3.0	(1.1, 4.9)	49.9	(36.4, 63.5)
Construction or reconstruction of mine facilities	10.5	(5.2, 15.9)	9.2	(1.3, 17.1)	121.0	(8.4, 233.6)
Demolition of mine facilities	DSU	DSU	DSU	DSU	DSU	DSU
Construction of dams	0.0	NA	NA	NA	NA	NA
Excavation or earthmoving activities (involving mobile equipment)	5.4	(2.3, 8.6)	4.4	(2.5, 6.2)	94.8	(46.7, 142.8)
Equipment installation	2.8	(0.2, 5.3)	2.0	(1.2, 2.9)	28.6	(13.0, 44.3)
Equipment service or repair of equipment on mine property (exceeding 5 consecutive days)	8.3	(4.7, 11.9)	2.2	(1.5, 2.8)	37.1	(18.0, 56.2)
Material handling (within mine property)	3.4	(0.0, 7.2)	4.1	(0.2, 8.0)	73.5	(44.2, 102.7)
Drilling and blasting	25.4	(19.9, 30.8)	2.3	(1.9, 2.6)	36.2	(27.0, 45.3)
Production support work	2.0	(0.2, 3.7)	4.0	(1.3, 6.6)	77.1	(17.0, 137.2)
Mineral extraction	DSU	DSU	DSU	DSU	DSU	DSU
Other work	DSU	DSU	DSU	DSU	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 163. Communication Devices and Systems at Stone Mines

Response	Percentage of Mines	95% CI
Dedicated telephones	48.2	(39.7, 56.6)
Mine page phones	2.4	(1.3, 3.5)
Trolley phones	0.0	NA
Shaft or hoist phones	DSU	DSU
Cell phones	86.0	(79.6, 92.5)
Voice over internet protocol (VOIP) phones	DSU	DSU
Hand-held two-way radios	61.8	(49.4, 74.2)
Wireless paging devices	3.3	(0.7, 6.0)
Leaky feeder communications system (not running a PED)	0.6	(0.1, 1.0)
Personal emergency device (PED) cap lamp/pager	0.0	NA
Through-the-Earth (TTE) technology (other than a PED)	DSU	DSU
Inductive coupled radios	DSU	DSU
Ethernet	3.6	(2.3, 4.9)
TRACKER tagging system	0.0	NA
Longwall face communication systems	NA	NA
None of the above	DSU	DSU
Other	22.4	(14.9, 30.0)

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 164. Personal Locators, Trackers, and Devices at Stone Mines

Response	Percentage of Mines	95% CI
Electronic or computerized tagging or tracking	DSU	DSU
Tag boards	6.2	(3.3, 9.0)
Reflective vests/clothing	30.6	(20.3, 41.0)
Chemical light sticks	DSU	DSU
Lighted vests	DSU	DSU
Laser lights/pointers	0.0	NA
Strobe lights	9.5	(3.1, 15.9)
None of the above	63.2	(53.0, 73.4)
Other	6.6	(2.4, 10.9)

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 165. Emergency Early Warning Methods at Stone Mines

Response	Percentage of Mines	95% CI
Stench gas	DSU	DSU
Audible systems	34.2	(26.8, 41.7)
Visual systems	14.3	(9.4, 19.1)
Pager phones	3.2	(0.4, 6.0)
Telephones	48.5	(41.0, 56.1)
Messengers	18.2	(11.0, 25.4)
Electronic personal communication systems	DSU	DSU
None of the above	20.4	(15.2, 25.7)
Other	20.1	(11.6, 28.7)

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 166. Rescue Teams at Stone Mines

Response	Percentage of Mines	95% CI
Mine has own rescue team	7.6	(1.3, 14.0)
Average number of rescue team members	6.6	(3.6, 9.6)
Frequency of team training		
Less than once a year	DSU	DSU
Annually	82.7	(57.0, 100.0)
Less than once a month	DSU	DSU
Once a month	DSU	DSU
Once every 2 weeks	0.0	NA
Once a week	0.0	NA
Other time interval	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Mine Statistics for Underground Stone Mines

Summary of Mine Statistics for Underground Stone Mines

The data for training and non-English languages can be found in Tables 167–170. For underground stone mines, the weighted survey estimates indicate that more training is conducted by the mine's employees including: annual refresher training (75.0 percent), newly hired inexperienced miner training (74.9 percent), and newly hired experienced miner training (78.0 percent) when compared to the mine's use of outside trainers. Lectures (93.9 percent), written materials (93.5 percent), and videos (86.3 percent) are the top three methods and materials used for training. Estimates from the survey indicate that 39.4 percent of underground stone mines have safety meetings once a week. Approximately seven percent of underground stone mine employees use a language other than English.

Tables 171 and 172 present the national estimates for work schedules and shift work. The average number of hours worked per week is 45.8 for production workers, 45.2 for production support workers, and 47.7 for preparation plant/mill workers. The majority of underground stone mines operate one shift per day (75.1 percent for production workers, 89.6 percent for production support workers, and 72.0 percent for preparation plant/mill workers).

National estimates for independent contractor employees are presented in Table 173. During a typical week, underground stone mines use independent contractor employees for equipment service or repair of equipment on mine property (17.2 percent). The other data in this table have been suppressed due to a survey count of less than five responses.

Tables 174–179 present national estimates for safety, communication, and rescue measures. Hand-held two-way radios (84.3 percent) are the most frequently used communication system followed by dedicated telephones (67.0 percent), and cell phones (58.9 percent). Tag boards (96.6 percent) and reflective vests/clothing (57.6 percent) are the most frequently used personal locators/trackers in underground stone mines. Signage (83.2 percent) and colored reflectors (60.5 percent) are the most frequently reported escape aids. First aid kits (82.3 percent), filter self-rescuers (60.9 percent), and belt-worn self-contained self-rescuers (SCSRs) (46.0 percent) are the top three emergency equipment and supplies found in these mines. Eighty-two percent of underground stone mines use visual systems for emergency early warnings. Approximately 18 percent of underground stone mines report having their own mine rescue team composed of 26 team members. The frequency of rescue teams training data have been suppressed due to a survey count of less than five responses.

Table 167. Miner Training Within the Past 12 Months at Underground Stone Mines

Training Conducted by	Percentage of Mines	95% CI
Mine employees		
Annual miner refresher	75.0	(58.3, 91.6)
Newly hired inexperienced miner	74.9	(60.1, 89.6)
Newly hired experienced miner	78.0	(63.3, 92.8)
Outside trainer		
Annual miner refresher	51.7	(33.1, 70.3)
Newly hired inexperienced miner	34.6	(18.7, 50.6)
Newly hired experienced miner	21.3	(5.8, 36.7)
Outside contract trainer		
Annual miner refresher	61.2	(40.1, 82.4)
Newly hired inexperienced miner	70.8	(47.1, 94.5)
Newly hired experienced miner	DSU	DSU
Outside state grantee		
Annual miner refresher	25.2	(6.1, 44.2)
Newly hired inexperienced miner	DSU	DSU
Newly hired experienced miner	DSU	DSU
Outside other trainer		
Annual miner refresher	DSU	DSU
Newly hired inexperienced miner	DSU	DSU
Newly hired experienced miner	DSU	DSU

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 168. Frequency of Periodic Safety Meetings at Underground Stone Mines

Response	Percentage of Mines	95% CI
Less than once a year	0.0	NA
Annually	DSU	DSU
Less than once a month	DSU	DSU
Once a month	35.0	(16.5, 53.6)
Once every 2 weeks	DSU	DSU
Once a week	39.4	(22.7, 56.1)
Several times a week	0.0	NA
Daily	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 169. Employee Safety Training Materials and Methods at Underground Stone Mines

Response	Percentage of Mines	95% CI
Lectures	93.9	(86.8, 100.0)
Written materials	93.5	(84.5, 100.0)
Videos	86.3	(73.4, 99.1)
Self-guided interactive computer programs	15.7	(4.9, 26.5)
Demonstrations	82.9	(69.5, 96.2)
Hands-on training exercises	63.9	(45.6, 82.2)
Group exercises (role playing, games, problem solving)	34.1	(13.0, 55.1)
Classroom simulations (e.g., virtual reality)	24.1	(13.0, 35.3)
Worksite simulations	45.8	(30.6, 61.0)
Narrative storytelling	65.8	(52.9, 78.7)
Other	DSU	DSU

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 170. Non-English Languages at Underground Stone Mines

Response	Percentage	95% CI
Employees use a language other than English to communicate	7.4	(0.0, 15.1)
Mining operations provide training materials, signs, or written materials, in language(s) other than English	22.3	(4.7, 39.9)
Which Language(s) are provided[1]		
Spanish	100.0	NA
Other	0.0	NA
Helpful to have training materials, signs, or written materials in other languages, in addition to those already provided	DSU	DSU
Helpful to have training materials, signs, or written materials in language(s) other than English	DSU	DSU

[1]Multiple responses permitted. Abbreviations: DSU, data suppressed; NA, not applicable.

Note: Data are national estimates.

Table 171. Work Schedules at Underground Stone Mines

Response	Production Workers	95% CI	Production Support Workers	95% CI	Preparation Plant/Mill Workers	95% CI
Scheduled days per week (average)	4.9	(4.7, 5.1)	5.1	(4.9, 5.3)	5.0	(4.6, 5.4)
Scheduled hours per day (average)	9.5	(9.2, 9.9)	9.4	(9.1, 9.8)	9.8	(9.4, 10.1)
Actual hours worked per week (average)	45.8	(41.6, 50.0)	45.2	(41.3, 49.2)	47.7	(42.8, 52.6)
Work crews change shifts at active mining site (percentage)	18.5	(3.8, 33.2)	DSU	DSU	NA	NA
Average time spent traveling to and from active mining site while being paid (hours)	1.5	(1.2, 1.8)	1.6	(1.3, 1.9)	NA	NA

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 172. Shift Work Schedules at Underground Stone Mines

Response	Production Workers Percentage of Mines	95% CI	Production Support Workers Percentage of Mines	95% CI	Preparation Plant/Mill Workers Percentage of Mines	95% CI
Number of shifts per day						
1 shift	75.1	(61.4, 88.9)	89.6	(78.3, 100.0)	72.0	(56.1, 88.0)
2 shifts	21.1	(10.5, 31.8)	DSU	DSU	DSU	DSU
3 shifts	DSU	DSU	DSU	DSU	DSU	DSU
4 shifts	0.0	NA	0.0	NA	0.0	NA
Rotating shifts	DSU	DSU	DSU	DSU	DSU	DSU
Frequency workers rotate shifts						
Weekly	DSU	DSU	DSU	DSU	DSU	DSU
Twice a month	DSU	DSU	DSU	DSU	DSU	DSU
Monthly	DSU	DSU	DSU	DSU	DSU	DSU
Other	DSU	DSU	DSU	DSU	DSU	DSU
Direction the shift rotates						
Clockwise (day—afternoon—night)	DSU	DSU	DSU	DSU	DSU	DSU
Counterclockwise (night—afternoon—day)	DSU	DSU	DSU	DSU	DSU	DSU
Other	DSU	DSU	DSU	DSU	DSU	DSU
Unique work shifts	0.0	NA	DSU	DSU	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

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Table 173. Activities of Independent Contractor Employees During the Reporting Week at Underground Stone Mines

Response	Percentage of Mines Reporting Contractors	95% CI	Average Number of Contractor Employees	95% CI	Average Total Hours	95% CI
Mine development	DSU	DSU	DSU	DSU	DSU	DSU
Construction or reconstruction of mine facilities	DSU	DSU	DSU	DSU	DSU	DSU
Demolition of mine facilities	0.0	NA	NA	NA	NA	NA
Construction of dams	0.0	NA	NA	NA	NA	NA
Excavation or earthmoving activities (involving mobile equipment)	DSU	DSU	DSU	DSU	DSU	DSU
Equipment installation	0.0	NA	NA	NA	NA	NA
Equipment service or repair of equipment on mine property (exceeding 5 consecutive days)	17.2	(3.8, 30.6)	2.2	(1.4, 3.1)	24.9	(15.2, 34.6)
Material handling (within mine property)	DSU	DSU	DSU	DSU	DSU	DSU
Drilling and blasting	DSU	DSU	DSU	DSU	DSU	DSU
Production support work	DSU	DSU	DSU	DSU	DSU	DSU
Mineral extraction	0.0	NA	NA	NA	NA	NA
Other work	0.0	NA	NA	NA	NA	NA

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 174. Communication Devices and Systems at Underground Stone Mines

Response	Percentage of Mines	95% CI
Dedicated telephones	67.0	(49.6, 84.4)
Mine page phones	39.9	(22.3, 57.5)
Trolley phones	0.0	NA
Shaft or hoist phones	DSU	DSU
Cell phones	58.9	(36.9, 80.9)
Voice over internet protocol (VOIP) phones	0.0	NA
Hand-held two-way radios	84.3	(68.6, 100.0)
Wireless paging devices	DSU	DSU
Leaky feeder communications system (not running a PED)	20.6	(5.7, 35.6)
Personal emergency device (PED) cap lamp/pager	0.0	NA
Through-the-Earth (TTE) technology (other than a PED)	DSU	DSU
Inductive coupled radios	0.0	NA
Ethernet	0.0	NA
TRACKER tagging system	0.0	NA
Longwall face communication systems	NA	NA
None of the above	0.0	NA
Other	24.7	(10.9, 38.5)

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 175. Personal Locators, Trackers, and Devices at Underground Stone Mines

Response	Percentage of Mines	95% CI
Electronic or computerized tagging or tracking	0.0	NA
Tag boards	96.6	(91.5, 100.0)
Reflective vests/clothing	57.6	(39.9, 75.2)
Chemical light sticks	DSU	DSU
Lighted vests	0.0	NA
Laser lights/pointers	0.0	NA
Strobe lights	40.3	(22.2, 58.5)
None of the above	0.0	NA
Other	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 176. Emergency Early Warning Methods at Underground Stone Mines

Response	Percentage of Mines	95% CI
Stench gas	DSU	DSU
Audible systems	58.8	(42.4, 75.2)
Visual systems	81.8	(73.6, 90.0)
Pager phones	DSU	DSU
Telephones	38.1	(18.8, 57.3)
Messengers	37.8	(20.2, 55.3)
Electronic personal communication systems	DSU	DSU
None of the above	0.0	NA
Other	25.6	(6.5, 44.6)

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 177. Rescue Teams at Underground Stone Mines

Response	Percentage of Mines	95% CI
Mine has own rescue team	18.2	(6.3, 30.1)
Average number of rescue team members	26.1	(10.8, 41.5)
Frequency of team training		
Less than once a year	0.0	NA
Annually	DSU	DSU
Less than once a month	DSU	DSU
Once a month	DSU	DSU
Once every 2 weeks	0.0	NA
Once a week	0.0	NA
Other time interval	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 178. Emergency Equipment and Supplies at Underground Stone Mines

Response	Percentage of Mines	95% CI
Belt-worn self-contained self-rescuers (SCSRs)	46.0	(28.9, 63.1)
Cached self-contained self-rescuers (SCSRs)	DSU	DSU
Filter self-rescuers (FSRs)	60.9	(44.9, 76.8)
Stationary emergency refuge chambers	DSU	DSU
Mobile emergency refuge chambers	DSU	DSU
Sealing materials	0.0	NA
Cached water/food supplies	DSU	DSU
First aid kits	82.3	(70.6, 94.0)
Defibrillator	35.0	(18.8, 51.1)
None of the above	0.0	NA
Other	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 179. Escape Aids at Underground Stone Mines

Response	Percentage of Mines	95% CI
Lifelines	DSU	DSU
Directional lifelines	0.0	NA
Signage	83.2	(69.5, 96.8)
Colored reflectors	60.5	(44.4, 76.5)
Lighting	37.3	(18.0, 56.7)
Strobe lights	21.0	(5.0, 37.1)
None of the above	0.0	NA
Other	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Mine Statistics for Surface Stone Mines

Summary of Mine Statistics for Surface Stone Mines

The data for training and non-English languages can be found in Tables 180–183. For surface stone mines, the weighted survey estimates indicate that more training is conducted by the mine's employees including: annual refresher training (75.0 percent), newly hired inexperienced miner training (75.1 percent), and newly hired experienced miner training (65.7 percent) when compared to the mine's use of outside trainers. Lectures (91.0 percent), written materials (88.7 percent), and videos (82.2 percent) are the top three methods and materials used for training. Estimates from the survey indicate that 46.2 percent of surface stone mines have employee safety meetings once a week. Approximately 12 percent of surface stone mine employees use a language other than English.

Tables 184 and 185 present the national estimates for work schedules and shift work. The average number of hours worked per week is 40.5 for production workers, 41.3 for production support workers, and 42.3 for preparation plant/mill workers. The majority of surface stone mines operate one shift per day (81.9 percent for production workers, 85.9 percent for production support workers, and 80.4 percent for preparation plant/mill workers).

National estimates for independent contractor employees are presented in Table 186. During a typical week, surface stone mines use independent contractor employees for various types of work including: drilling and blasting (25.7 percent), construction or reconstruction of mine facilities (10.7 percent), equipment service or repair of equipment on mine property (8.1 percent), and excavation or earthmoving activities (5.4 percent).

Tables 187–190 present national estimates for safety, communication, and rescue measures. Cell phones (86.8 percent) are the most frequently used communication system followed by hand-held two-way radios (61.2 percent) and dedicated telephones (47.7 percent). Forty-nine percent of surface stone mines use telephones for emergency early warnings. Approximately seven percent of surface stone mines report having their own mine rescue team composed of about five team members. The majority of mine rescue teams train on an annual basis (84.2 percent).

Table 180. Miner Training Within the Past 12 Months at Surface Stone Mines

Training Conducted by	Percentage of Mines	95% CI
Mine employees		
Annual miner refresher	75.0	(67.5, 82.4)
Newly hired inexperienced miner	75.1	(68.0, 82.2)
Newly hired experienced miner	65.7	(57.9, 73.6)
Outside trainer		
Annual miner refresher	49.2	(39.7, 58.7)
Newly hired inexperienced miner	18.1	(9.8, 26.3)
Newly hired experienced miner	15.8	(8.6, 23.0)
Outside contract trainer		
Annual miner refresher	59.0	(49.2, 68.8)
Newly hired inexperienced miner	65.0	(39.6, 90.4)
Newly hired experienced miner	78.3	(63.6, 93.1)
Outside state grantee		
Annual miner refresher	29.3	(15.5, 43.0)
Newly hired inexperienced miner	25.3	(0.0, 52.5)
Newly hired experienced miner	DSU	DSU
Outside other trainer		
Annual miner refresher	11.4	(4.2, 18.7)
Newly hired inexperienced miner	DSU	DSU
Newly hired experienced miner	DSU	DSU

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 181. Frequency of Periodic Safety Meetings at Surface Stone Mines

Response	Percentage of Mines	95% CI
Less than once a year	0.0	NA
Annually	DSU	DSU
Less than once a month	10.8	(7.3, 14.2)
Once a month	16.5	(9.7, 23.2)
Once every 2 weeks	6.9	(2.7, 11.2)
Once a week	46.2	(33.8, 58.6)
Several times a week	6.0	(2.7, 9.3)
Daily	12.0	(2.9, 21.1)

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 182. Employee Safety Training Materials and Methods at Surface Stone Mines

Response	Percentage of Mines	95% CI
Lectures	91.0	(85.5, 96.5)
Written materials	88.7	(80.1, 97.3)
Videos	82.2	(75.9, 88.5)
Self-guided interactive computer programs	16.7	(10.6, 22.8)
Demonstrations	71.4	(60.8, 81.9)
Hands-on training exercises	66.1	(59.8, 72.5)
Group exercises (role playing, games, problem solving)	39.7	(32.5, 46.9)
Classroom simulations (e.g., virtual reality)	7.4	(3.4, 11.3)
Worksite simulations	31.5	(25.0, 38.1)
Narrative storytelling	53.9	(45.7, 62.0)
Other	3.6	(1.0, 6.1)

Notes: Data are national estimates; multiple responses permitted.

Table 183. Non-English Languages at Surface Stone Mines

Response	Percentage	95% CI
Employees use a language other than English to communicate	12.0	(5.5, 18.4)
Mining operations provide training materials, signs, or written materials, in language(s) other than English	33.2	(22.9, 43.6)
Which Language(s) are provided[1]		
Spanish	100.0	NA
Other	DSU	DSU
Helpful to have training materials, signs, or written materials in other languages, in addition to those already provided	36.4	(16.7, 56.0)
Helpful to have training materials, signs, or written materials in language(s) other than English	13.1	(6.5, 19.7)

[1]Multiple responses permitted. Abbreviations: DSU, data suppressed; NA, not applicable.

Note: Data are national estimates.

Table 184. Work Schedules at Surface Stone Mines

Response	Production Workers	95% CI	Production Support Workers	95% CI	Preparation Plant/Mill Workers	95% CI
Scheduled days per week (average)	4.9	(4.9, 5.0)	5.0	(5.0, 5.1)	4.9	(4.8, 5.1)
Scheduled hours per day (average)	9.0	(8.7, 9.3)	10.4	(8.6, 12.1)	9.0	(8.6, 9.4)
Actual hours worked per week (average)	40.5	(38.5, 42.5)	41.3	(38.0, 44.6)	42.3	(38.6, 46.0)
Work crews change shifts at active mining site (percentage)	8.0	(4.8, 11.2)	5.6	(1.5, 9.6)	NA	NA
Average time spent traveling to and from active mining site while being paid (hours)	1.5	(1.3, 1.6)	1.5	(1.4, 1.7)	NA	NA

Abbreviation: NA, not applicable. Note: Data are national estimates.

Table 185. Shift Work Schedules at Surface Stone Mines

Response	Production Workers Percentage of Mines	95% CI	Production Support Workers Percentage of Mines	95% CI	Preparation Plant/Mill Workers Percentage of Mines	95% CI
Number of shifts per day						
1 shift	81.9	(76.9, 86.8)	85.9	(79.3, 92.4)	80.4	(74.5, 86.3)
2 shifts	15.8	(10.4, 21.1)	10.8	(4.3, 17.2)	12.7	(6.4, 19.1)
3 shifts	2.2	(0.2, 4.2)	3.4	(1.7, 5.0)	5.1	(3.0, 7.2)
4 shifts	DSU	DSU	0.0	NA	DSU	DSU
Rotating shifts	3.2	(0.6, 5.7)	2.5	(1.2, 3.9)	3.9	(2.0, 5.9)
Frequency workers rotate shifts						
Weekly	94.9	(85.1, 100.0)	83.3	(61.9, 100.0)	69.1	(40.3, 97.8)
Twice a month	DSU	DSU	DSU	DSU	0.0	NA
Monthly	0.0	NA	DSU	DSU	DSU	DSU
Other	0.0	NA	0.0	NA	DSU	DSU
Direction the shift rotates						
Clockwise (day—afternoon—night)	79.7	(59.9, 99.5)	66.8	(40.4, 93.2)	84.4	(63.1, 100.0)
Counterclockwise (night—afternoon—day)	DSU	DSU	DSU	DSU	0.0	NA
Other	DSU	DSU	DSU	DSU	DSU	DSU
Unique work shifts	1.7	(0.5, 2.8)	DSU	DSU	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 186. Activities of Independent Contractor Employees During the Reporting Week at Surface Stone Mines

Response	Percentage of Mines Reporting Contractors	95% CI	Average Number of Contractor Employees	95% CI	Average Total Hours	95% CI
Mine development	DSU	DSU	DSU	DSU	DSU	DSU
Construction or reconstruction of mine facilities	10.7	(5.2, 16.1)	9.3	(1.3, 17.3)	122.2	(7.5, 236.8)
Demolition of mine facilities	DSU	DSU	DSU	DSU	DSU	DSU
Construction of dams	0.0	NA	NA	NA	NA	NA
Excavation or earthmoving activities (involving mobile equipment)	5.4	(2.2, 8.6)	4.3	(2.4, 6.2)	87.0	(42.0, 132.1)
Equipment installation	2.8	(0.2, 5.5)	2.0	(1.2, 2.9)	28.6	(13.0, 44.3)
Equipment service or repair of equipment on mine property (exceeding 5 consecutive days)	8.1	(4.4, 11.7)	2.2	(1.5, 2.9)	37.8	(17.4, 58.1)
Material handling (within mine property)	3.4	(0.0, 7.3)	4.2	(0.2, 8.2)	74.0	(44.0, 104.1)
Drilling and blasting	25.7	(20.1, 31.3)	2.3	(1.9, 2.6)	36.0	(26.7, 45.3)
Production support work	1.8	(0.1, 3.6)	3.8	(1.0, 6.7)	69.3	(8.8, 129.8)
Mineral extraction	DSU	DSU	DSU	DSU	DSU	DSU
Other work	DSU	DSU	DSU	DSU	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 187. Communication Devices and Systems at Surface Stone Mines

Response	Percentage of Mines	95% CI
Dedicated telephones	47.7	(39.0, 56.4)
Mine page phones	1.4	(0.3, 2.4)
Trolley phones	0.0	NA
Shaft or hoist phones	NA	NA
Cell phones	86.8	(80.2, 93.3)
Voice over internet protocol (VOIP) phones	DSU	DSU
Hand-held two-way radios	61.2	(48.5, 73.9)
Wireless paging devices	3.3	(0.6, 6.1)
Leaky feeder communications system (not running a PED)	0.0	NA
Personal emergency device (PED) cap lamp/pager	0.0	NA
Through-the-Earth (TTE) technology (other than a PED)	0.0	NA
Inductive coupled radios	DSU	DSU
Ethernet	3.7	(2.4, 5.0)
TRACKER tagging system	0.0	NA
Longwall face communication systems	NA	NA
None of the above	DSU	DSU
Other	22.4	(14.7, 30.1)

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 188. Personal Locators, Trackers, and Devices at Surface Stone Mines

Response	Percentage of Mines	95% CI
Electronic or computerized tagging or tracking	DSU	DSU
Tag boards	DSU	DSU
Reflective vests/clothing	29.9	(19.2, 40.5)
Chemical light sticks	DSU	DSU
Lighted vests	DSU	DSU
Laser lights/pointers	0.0	NA
Strobe lights	8.6	(2.1, 15.2)
None of the above	65.0	(54.5, 75.4)
Other	6.7	(2.3, 11.2)

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 189. Emergency Early Warning Methods at Surface Stone Mines

Response	Percentage of Mines	95% CI
Stench gas	0.0	NA
Audible systems	33.5	(25.9, 41.2)
Visual systems	12.4	(7.4, 17.4)
Pager phones	2.9	(0.0, 5.8)
Telephones	48.8	(41.1, 56.6)
Messengers	17.6	(10.2, 25.0)
Electronic personal communication systems	DSU	DSU
None of the above	21.0	(15.6, 26.4)
Other	20.0	(11.2, 28.8)

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 190. Rescue Teams at Surface Stone Mines

Response	Percentage of Mines	95% CI
Mine has own rescue team	7.3	(0.8, 13.9)
Average number of rescue team members	5.3	(3.6, 6.9)
Frequency of team training		
Less than once a year	DSU	DSU
Annually	84.2	(57.7, 100.0)
Less than once a month	0.0	NA
Once a month	DSU	DSU
Once every 2 weeks	0.0	NA
Once a week	0.0	NA
Other time interval	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Mine Statistics for Sand and Gravel Mines

Summary of Mine Statistics for Sand and Gravel Mines

The data for training and non-English languages can be found in Tables 191–194. For the U.S. sand and gravel mining industry, the weighted survey estimates indicate that more training is conducted by the mine's employees including: annual refresher training (67.8 percent); newly hired inexperienced miner training (59.0 percent); and newly hired experienced miner training (54.5 percent) when compared to the mine's use of outside trainers. Lectures (81.9 percent), written materials (81.0 percent) and videos (74.5 percent) are the top three methods and materials used for training. Estimates from the survey indicate that 35.1 percent of all sand and gravel mines have employee safety meetings once a week. Overall, approximately six percent of mine employees use a language other than English.

Tables 195 and 196 present the national estimates for work schedules and shift work. The average number of hours worked per week is 36.8 for production workers, 35.3 for production support workers, and 31.7 for preparation plant/mill workers. The majority of sand and gravel mines operate one shift per day (84.8 percent for production workers, 89.0 percent for production support workers, and 79.2 percent for preparation plant/mill workers).

National estimates for independent contractor employees are presented in Table 197. During a typical week, sand and gravel mines use independent contractor employees for various types of work including: equipment service or repair of equipment on mine property (4.6 percent); construction or reconstruction of mine facilities (4.4 percent); excavation or earthmoving activities (3.2 percent); and equipment installation (1.8 percent).

Tables 198–201 present national estimates for safety, communication, and rescue measures. Cell phones (95.3 percent) are the most frequently used communication system followed by hand-held two-way radios (62.0 percent), and dedicated telephones (30.9 percent). Forty-seven percent of sand and gravel mines use telephones for emergency early warnings. Five percent of sand and gravel mines report having their own mine rescue team composed of approximately three team members. The majority of mine rescue teams train on an annual basis (81.2 percent).

Table 191. Miner Training Within the Past 12 Months at Sand and Gravel Mines

Training Conducted by	Percentage of Mines	95% CI
Mine employees		
Annual miner refresher	67.8	(62.1, 73.4)
Newly hired inexperienced miner	59.0	(51.9, 66.0)
Newly hired experienced miner	54.5	(48.8, 60.2)
Outside trainer		
Annual miner refresher	63.6	(55.3, 71.9)
Newly hired inexperienced miner	16.6	(13.4, 19.9)
Newly hired experienced miner	12.4	(4.9, 19.9)
Outside contract trainer		
Annual miner refresher	42.2	(33.0, 51.4)
Newly hired inexperienced miner	45.0	(26.8, 63.2)
Newly hired experienced miner	46.3	(26.9, 65.7)
Outside state grantee		
Annual miner refresher	41.5	(26.6, 56.4)
Newly hired inexperienced miner	52.6	(21.9, 83.3)
Newly hired experienced miner	50.1	(5.7, 94.5)
Outside other trainer		
Annual miner refresher	21.5	(14.0, 29.0)
Newly hired inexperienced miner	DSU	DSU
Newly hired experienced miner	DSU	DSU

Abbreviation: DSU, data suppressed.

Notes: Data are national estimates; multiple responses permitted.

Table 192. Frequency of Periodic Safety Meetings at Sand and Gravel Mines

Response	Percentage of Mines	95% CI
Less than once a year	DSU	DSU
Annually	8.6	(4.4, 12.8)
Less than once a month	8.9	(4.4, 13.4)
Once a month	25.8	(18.5, 33.2)
Once every 2 weeks	7.3	(2.5, 12.1)
Once a week	35.1	(25.3, 44.9)
Several times a week	5.6	(2.5, 8.8)
Daily	5.3	(1.0, 9.7)

Abbreviation: DSU, data suppressed. Note: Data are national estimates.

Table 193. Employee Safety Training Materials and Methods at Sand and Gravel Mines

Response	Percentage of Mines	95% CI
Lectures	81.9	(77.1, 86.6)
Written materials	81.0	(75.5, 86.6)
Videos	74.5	(70.7, 78.4)
Self-guided interactive computer programs	20.8	(12.2, 29.4)
Demonstrations	52.9	(41.9, 63.8)
Hands-on training exercises	62.0	(53.9, 70.2)
Group exercises (role playing, games, problem solving)	24.3	(19.2, 29.4)
Classroom simulations (e.g., virtual reality)	11.5	(7.4, 15.6)
Worksite simulations	31.3	(23.5, 39.0)
Narrative storytelling	41.8	(33.0, 50.7)
Other	2.1	(0.0, 4.2)

Notes: Data are national estimates; multiple responses permitted.

Table 194. Non-English Languages at Sand and Gravel Mines

Response	Percentage	95% CI
Employees use a language other than English to communicate	5.7	(2.6, 8.7)
Mining operations provide training materials, signs, or written materials, in language(s) other than English	15.3	(9.3, 21.2)
Which Language(s) are provided[1]		
Spanish	100.0	NA
Other	0.0	NA
Helpful to have training materials, signs, or written materials in other languages, in addition to those already provided	33.9	(13.3, 54.4)
Helpful to have training materials, signs, or written materials in language(s) other than English	9.8	(6.0, 13.7)

[1]Multiple responses permitted. Abbreviation: NA, not applicable.

Note: Data are national estimates.

Table 195. Work Schedules at Sand and Gravel Mines

Response	Production Workers	95% CI	Production Support Workers	95% CI	Preparation Plant/Mill Workers	95% CI
Scheduled days per week (average)	4.6	(4.5, 4.7)	4.7	(4.5, 4.8)	4.7	(4.5, 4.9)
Scheduled hours per day (average)	9.1	(8.8, 9.3)	9.5	(7.8, 11.2)	8.8	(7.7, 9.9)
Actual hours worked per week (average)	36.8	(33.8, 39.8)	35.3	(32.2, 38.3)	31.7	(22.5, 41.0)
Work crews change shifts at active mining site (percentage)	9.0	(5.5, 12.4)	11.4	(6.0, 16.8)	NA	NA
Average time spent traveling to and from active mining site while being paid (hours)	1.6	(1.5, 1.8)	1.6	(1.4, 1.8)	NA	NA

Abbreviation: NA, not applicable. Note: Data are national estimates.

Table 196. Shift Work Schedules at Sand and Gravel Mines

Response	Production Workers Percentage of Mines	95% CI	Production Support Workers Percentage of Mines	95% CI	Preparation Plant/Mill Workers Percentage of Mines	95% CI
Number of shifts per day						
1 shift	84.8	(79.5, 90.0)	89.0	(82.6, 95.5)	79.2	(63.5, 94.9)
2 shifts	12.0	(6.9, 17.1)	10.2	(4.2, 16.2)	18.0	(4.2, 31.7)
3 shifts	DSU	DSU	DSU	DSU	DSU	DSU
4 shifts	DSU	DSU	0.0	NA	0.0	NA
Rotating shifts	3.6	(0.1, 7.1)	DSU	DSU	DSU	DSU
Frequency workers rotate shifts						
Weekly	DSU	DSU	DSU	DSU	DSU	DSU
Twice a month	DSU	DSU	DSU	DSU	DSU	DSU
Monthly	DSU	DSU	DSU	DSU	DSU	DSU
Other	0.0	NA	DSU	DSU	DSU	DSU
Direction the shift rotates						
Clockwise (day—afternoon—night)	100.0	NA	DSU	DSU	DSU	DSU
Counterclockwise (night—afternoon—day)	0.0	NA	DSU	DSU	DSU	DSU
Other	0.0	NA	DSU	DSU	DSU	DSU
Unique work shifts	DSU	DSU	DSU	DSU	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 197. Activities of Independent Contractor Employees During the Reporting Week at Sand and Gravel Mines

Response	Percentage of Mines Reporting Contractors	95% CI	Average Number of Contractor Employees	95% CI	Average Total Hours	95% CI
Mine development	DSU	DSU	DSU	DSU	DSU	DSU
Construction or reconstruction of mine facilities	4.4	(0.9, 7.9)	2.0	(1.6, 2.5)	30.9	(12.0, 49.8)
Demolition of mine facilities	0.0	NA	NA	NA	NA	NA
Construction of dams	DSU	DSU	DSU	DSU	DSU	DSU
Excavation or earthmoving activities (involving mobile equipment)	3.2	(0.2, 6.2)	1.1	(0.9, 1.3)	44.0	(29.6, 58.4)
Equipment installation	1.8	(0.0, 3.8)	1.5	(0.8, 2.2)	41.3	(24.6, 58.0)
Equipment service or repair of equipment on mine property (exceeding 5 consecutive days)	4.6	(1.8, 7.4)	1.7	(1.0, 2.5)	46.3	(6.0, 86.6)
Material handling (within mine property)	DSU	DSU	DSU	DSU	DSU	DSU
Drilling and blasting	0.7	(0.0, 1.8)	3.1	(2.1, 4.1)	33.3	(9.2, 57.4)
Production support work	DSU	DSU	DSU	DSU	DSU	DSU
Mineral extraction	DSU	DSU	DSU	DSU	DSU	DSU
Other work	DSU	DSU	DSU	DSU	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

Table 198. Communication Devices and Systems at Sand and Gravel Mines

Response	Percentage of Mines	95% CI
Dedicated telephones	30.9	(21.8, 40.0)
Mine page phones	2.8	(0.0, 5.8)
Trolley phones	0.0	NA
Shaft or hoist phones	NA	NA
Cell phones	95.3	(91.6, 99.0)
Voice over internet protocol (VOIP) phones	DSU	DSU
Hand-held two-way radios	62.0	(56.0, 67.9)
Wireless paging devices	3.9	(0.6, 7.1)
Leaky feeder communications system (not running a PED)	0.0	NA
Personal emergency device (PED) cap lamp/pager	DSU	DSU
Through-the-Earth (TTE) technology (other than a PED)	0.0	NA
Inductive coupled radios	DSU	DSU
Ethernet	1.6	(0.0, 3.8)
TRACKER tagging system	DSU	DSU
Longwall face communication systems	NA	NA
None of the above	0.0	NA
Other	19.1	(11.0, 27.2)

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 199. Personal Locators, Trackers, and Devices at Sand and Gravel Mines

Response	Percentage of Mines	95% CI
Electronic or computerized tagging or tracking	DSU	DSU
Tag boards	DSU	DSU
Reflective vests/clothing	36.9	(24.5, 49.3)
Chemical light sticks	DSU	DSU
Lighted vests	DSU	DSU
Laser lights/pointers	0.0	NA
Strobe lights	8.9	(3.3, 14.5)
None of the above	58.0	(45.1, 71.0)
Other	DSU	DSU

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 200. Emergency Early Warning Methods at Sand and Gravel Mines

Response	Percentage of Mines	95% CI
Stench gas	0.0	NA
Audible systems	24.3	(19.1, 29.5)
Visual systems	12.0	(5.8, 18.2)
Pager phones	2.5	(0.0, 5.4)
Telephones	46.9	(40.5, 53.3)
Messengers	12.0	(1.2, 22.8)
Electronic personal communication systems	DSU	DSU
None of the above	32.2	(21.6, 42.8)
Other	16.4	(10.7, 22.0)

Abbreviations: DSU, data suppressed; NA, not applicable.

Notes: Data are national estimates; multiple responses permitted.

Table 201. Rescue Teams at Sand and Gravel Mines

Response	Percentage of Mines	95% CI
Mine has own rescue team	4.6	(0.0, 9.3)
Average number of rescue team members	2.7	(2.3, 3.0)
Frequency of team training		
Less than once a year	DSU	DSU
Annually	81.2	(33.9, 100.0)
Less than once a month	0.0	NA
Once a month	0.0	NA
Once every 2 weeks	0.0	NA
Once a week	0.0	NA
Other time interval	0.0	NA

Abbreviations: DSU, data suppressed; NA, not applicable. Note: Data are national estimates.

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References

American Geological Institute [1997]. Dictionary of mining, mineral, and related terms. Alexandria, VA: American Geological Institute.

CAB Products [n.d.]. [http://cabproducts.com/products.php?ID=57&showallprod=].

CFR. Code of Federal Regulations. Washington, DC: U.S. Government Printing Office, Office of the Federal Register.

Cochran WG [1977]. Sampling Techniques, 3rd ed. New York: John Wiley & Sons, pp. 127–131.

FCC [2010]. Voice-over-internet protocol. Federal Communications Commission. [http://www.fcc.gov/voip].

Kennedy WR, Kennedy JM [1984]. Mine stopping [http://www.patents.com/us-4547094.html].

MSHA [n.d.a]. Description of MSHA-approved technologies. Washington, DC: U.S. Department of Labor, Mine Safety and Health Administration [http://www.msha.gov/techsupp/PEDLocating/MSHAApprovedPEDdescription.pdf].

MSHA [n.d.b]. Small mine office tool box talks. U.S. Department of Labor, Mine Safety and Health Administration, Small Mine Office [http://www.msha.gov/smallmineoffice/toolbox/tboxtalks.htm].

Mine Site Technologies [n.d.]. Underground tracking [http://www.minesite.com.au/mine-types/ug-coal-mines/underground-tracking/].

Murphy JN, Parkinson HE [1978]. Underground mine communications [http://www.wvminesafety.org/PDFs/Additional%20Information%20Table/Underground_Mine_Com_1.pdf].

NCHS [2002]. Statistical Notes Number 24. Healthy people 2010 criteria for data suppression. By Klein RJ, Proctor SE, Boudreault MA, Turczyn KM. Hyattsville, MD: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics. DHHS Publication No. (PHS) 2002-1237 2-0424.

NCHS [2004]. NCHS staff manual on confidentiality. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics.

NIOSH [2001]. Use of simulation exercises for safety training in the U.S. mining industry. By Cole HP, Wiehagen WJ, Vaught C, Mills BS. Pittsburgh, PA: U. S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2001-141.

NIOSH [2009]. Emergency communications and tracking. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) [http://www.cdc.gov/niosh/mining/mineract/communicationsandtracking.htm].

Sapko M, Weiss E, Trakemas J, Stephan C [2003]. Designs for rapid in situ sealing [http://www.cdc.gov/niosh/mining/pubs/pdfs/dfris.pdf].

Schiffbauer WH, Mowery GL, Brune JF [n.d.]. Through-the-earth and other types of communication systems for underground coal miners for disaster and normal operations [http://www.cdc.gov/niosh/mining/mineract/pdfs/commsystems.pdf].

Schiffbauer WH, Brune JF [2006]. Underground coal mine communications for emergencies and everyday operations [http://www.energyforum.nrcce.wvu.edu/docs/Brune.pdf].

Vaught C (Retired) [2008]. Glossary of mining terms. Private email message to Linda McWilliams (LMcWilliams@cdc.gov), March 28.

Wang Z, Waldron W [2010]. Using the SAS® survey procedures for subpopulation analysis with jackknife repeated replication methods in SAS 9.2. In: Proceedings of the SAS Global Forum, pp. 1–9.

Appendices

Appendix A. Questionnaire Booklet

Form Approved
OMB NO. 0920-0754
Exp. Date 10/31/2010

National Survey of the Mining Population

Questionnaire

SAFER • HEALTHIER • PEOPLE™

Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
Pittsburgh Research Laboratory
P.O. Box 18070
Pittsburgh, Pennsylvania 15236

Mine ID Number: «MineIDNumber»
Mine Name: «MineName»
Reporting Week: «ReportingWeek»

QUESTIONNAIRE OVERVIEW

This questionnaire contains five parts:

Items of Special Importance:

1. All responses you give should be for the specific Mine ID and name shown in the box above. Some items in the questionnaire are for a specific one-week period called the REPORTING WEEK, which is your payroll week that includes the date shown in the box above.

2. You have the option of completing either this survey questionnaire booklet or an Internet web-based survey questionnaire. The contents of both versions of the survey questionnaire are the same. Instructions to access the web-based questionnaire (www.miningsurvey.org) are attached to the cover letter included in the survey mailing.

3. If you have a question regarding your REPORTING WEEK, how to access the web-based questionnaire, or if you need assistance in completing any of the items, please call 1-888-814-4707. This is the toll-free number for Westat, the survey contractor.
4. Use the Comments section (Item F8 on Page 20) to explain any responses or situations unique to your mine.

MINE QUESTIONS

TRAINING

The first series of questions asks about miner training. This includes both **annual miner refresher training** and **new miner training**.

M1. In the past 12 months, did this mining operation use its *employees* to conduct. **[Please check "Yes" or "No" for each question a, b, and c below.]**

	Yes	No
a. annual miner refresher training?	☐	☐
b. training for newly hired *inexperienced* miners?	☐	☐
c. training for newly hired *experienced* miners?	☐	☐

M2. In the past 12 months, did this mining operation use an *outside trainer* to conduct **annual miner refresher training**?

☐ Yes ➔ **Go to Question M3**
☐ No ➔ **Go to Question M4 (next page)**

M3. **[IF YES TO Question M2]:** What type of *outside trainer* did you use? **[Please check ALL that apply.]**

☐ Contract trainer
☐ State grantee
☐ Other (**Please specify):**

____
____

TRAINING (continued)

M4. In the past 12 months, did this mining operation use an *outside trainer* to conduct training for newly hired *inexperienced* miners?

- ☐ Yes ➔ **Go to Question M5**
- ☐ No ➔ **Go to Question M6**

M5. **[IF YES TO Question M4]:** What type of *outside trainer* did you use? **[Please check ALL that apply.]**

- ☐ Contract trainer
- ☐ State grantee
- ☐ Other **(Please specify):**

____

____

M6. In the past 12 months, did this mining operation use an *outside trainer* to conduct training for newly hired *experienced* miners?

- ☐ Yes ➔ **Go to Question M7**
- ☐ No ➔ **Go to Question M8**

M7. **[IF YES TO Question M6]:** What type of *outside trainer* did you use? **[Please check ALL that apply.]**

- ☐ Contract trainer
- ☐ State grantee
- ☐ Other **(Please specify):**

____

____

M8. How frequently are periodic safety meetings (e.g., "toolbox talks"), for employees engaged in mining operations, conducted at this mine? **[Please check one.]**

- ☐ Less than once a year
- ☐ Annually
- ☐ Less than once a month
- ☐ Once a month
- ☐ Once every 2 weeks
- ☐ Once a week
- ☐ Several times a week
- ☐ Daily

M9. When conducting employee safety training and retraining, which of the following training materials and methods are used as part of your training program? **[Please check ALL that apply.]**

- ☐ Lectures
- ☐ Written materials
- ☐ Videos
- ☐ Self-guided interactive computer programs
- ☐ Demonstrations
- ☐ Hands-on training exercises
- ☐ Group exercises (role playing, games, problem solving, etc.)
- ☐ Classroom simulations (e.g., virtual reality)
- ☐ Worksite simulations
- ☐ Narrative story telling
- ☐ Other **(Please specify):**

____

____

OTHER LANGUAGES

The next series of questions asks about the use of languages other than English.

M10. Approximately what percentage of employees currently working at the mine use a language other than English to communicate?

_______________%

M11. Does this mining operation currently provide training materials, signs, or other written materials in a language other than English?

- ☐ Yes ➔ **Go to Question M12**
- ☐ No ➔ **Go to Question M14**

M12. **[IF YES TO Question M11]:** What language(s) is/are provided? **[Please check ALL that apply.]**

- ☐ Spanish
- ☐ Other **(Please specify):**

____

____

M13. Would it be helpful to have training materials, signs, or written materials in any other languages, *in addition* to those already provided by your mining operation?

- ☐ Yes ➔ **Go to Question M15**
- ☐ No ➔ **Go to Work Schedules Section (next page)**

M14. Would it be helpful to have training materials, signs, or other written materials in language(s) other than English?

- ☐ Yes ➔ **Go to Question M15**
- ☐ No ➔ **Go to Work Schedules Section (next page)**

M15. **[IF YES TO Question M13 or M14]:** Which languages? **[Please check ALL that apply.]**

- ☐ Spanish
- ☐ Other **(Please specify):**

____

____

WORK SCHEDULES

The next series of questions asks about how the mine schedules work for the following types of mine operator employees:

- **Production Workers** are 'face workers' and others who work extracting coal/ore/stone.
- **Production Support Workers** are those who aid and maintain production (e.g., by cleaning or moving belts, maintaining ventilation, delivering supplies, repairing equipment, etc. Office workers are also counted here).
- **Preparation Plant/Mill Workers** are those who operate or perform support activities in a preparation plant or mill.

We suggest, for this section and the next, that you first respond to all questions in Column A for Production Workers, and then go back to complete them in Column B for Production Support Workers, followed by the Column C items for Preparation Plant/Mill Workers.

WORK SCHEDULES	A. Production Workers	B. Production Support Workers	C. Preparation Plant/ Mill Workers
	☐ **CHECK** If this mine does not have any Production Workers and leave this column blank. If Box is **NOT CHECKED**, continue with this column.	☐ **CHECK** if this mine does not have any Production Support Workers (and no office workers), then leave this column blank. If Box is **NOT CHECKED**, continue with this column.	☐ **CHECK** if this mine does not have any Preparation Plant/Mill Workers and leave this column blank. If Box Is **NOT CHECKED**, continue with this column.
M16.a. On average, how many days per week are these workers *scheduled* to work?	|__| Scheduled days per week	|__| Scheduled days per week	|__| Scheduled days per week
b. On average, how many hours per day are these workers *scheduled* to work?	|__|__| Scheduled hours per day	|__|__| Scheduled hours per day	|__|__| Scheduled hours per day

WORK SCHEDULES (continued)

WORK SCHEDULES	A. Production Workers	B. Production Support Workers	C. Preparation Plant/ Mill Workers
M16.c. During the REPORTING WEEK (which includes the date shown in the box on Page 1), what was the average number of hours per week these workers *actually* worked (including overtime)?	|__|__| Actual work hours during REPORTING WEEK	|__|__| Actual work hours during REPORTING WEEK	|__|__| Actual work hours during REPORTING WEEK
d. Do work crews generally change shifts at the active mining site (e.g., the face or long wall - also known as a 'hot seat" change)?	☐ Yes ☐ No	☐ Yes ☐ No	QUESTIONS M16.d & e. NOT APPLICABLE FOR PREPARATION PLANT MILL WORKERS GO TO SHIFT WORK SECTION (Next Page)
e. On average, how much time per shift do workers spend traveling to and from the active mining site on-shift (while being paid)?	|__| |__|__| Hours Minutes round trip, per shift GO TO COLUMN B	|__| |__|__| Hours Minutes round trip, per shift GO TO COLUMN C	

SHIFT WORK

For the next series of questions, assume that the:

- **Day** shift begins in the morning hours (e.g., 6 a.m., 7 a.m., or 8 a.m.)
- **Afternoon** shift begins in the afternoon hours (e.g., 2 p.m. or 3 p.m.)
- **Night** or **Midnight** shift begins in the late evening hours (e.g., 11 p.m. or 12 a.m.)

SHIFT WORK	**A. Production Workers**	**B. Production Support Workers**	**C. Preparation Plant/ Mill Workers**
	☐ **CHECK** if this mine does not have any Production Workers and leave this column blank. If Box is **NOT CHECKED,** continue with this column.	☐ **CHECK** if this mine does not have any Production Support Workers (and no office workers), then leave this column blank. If Box is **NOT CHECKED**, continue with this column.	☐ **CHECK** if this mine does not have any Preparation Plant/Mill Workers and leave this column blank. If Box Is **NOT CHECKED**, continue with this column.
M17. Typically how many shifts per day does the mine operate for these workers?	|__| Shifts per day	|__| Shifts per day	| | Shifts per day
M18. Do they work rotating shifts?	☐ Yes → GO TO QUESTION M19 ☐ No → GO TO QUESTION M21 (Next Page)	☐ Yes → GO TO QUESTION M19 ☐ No → GO TO QUESTION M21 (Next Page)	☐ Yes → GO TO QUESTION M19 ☐ No → GO TO QUESTION M21 (Next Page)
M19. **[IF YES TO QUESTION M18]:** How frequently do these workers change their assigned shift?	☐ Weekly ☐ Twice a Month ☐ Monthly ☐ Other **(specify):**	☐ Weekly ☐ Twice a Month ☐ Monthly ☐ Other **(specify):** ________________ ________________	☐ Weekly ☐ Twice a Month ☐ Monthly ☐ Other **(specify):**

SHIFT WORK (continued)

SHIFT WORK	A. Production Workers	B. Production Support Workers	C. Preparation Plant/ Mill Workers
M20. Do they rotate shifts clockwise or counterclockwise? Note that *Clockwise* is **day→afternoon→night** *Counterclockwise* is **night→afternoon→day**	☐ Clockwise ☐ Counterclockwise ☐ Other **(specify):** ______________ ______________	☐ Clockwise ☐ Counterclockwise ☐ Other **(specify):** ______________ ______________	☐ Clockwise ☐ Counterclockwise ☐ Other **(specify):** ______________ ______________
M21. Are there any regularly scheduled ***unique*** work shifts that do not fit into the previous descriptions (e.g., a shift of three 12-hour days on Friday, Saturday, and Sunday, known as an "alternative work schedule" or "Weekend Warrior" shift)?	☐ Yes → GO TO QUESTION M22 ☐ No → GO TO COLUMN B	☐ Yes → GO TO QUESTION M22 ☐ No → GO TO COLUMN C	☐ Yes → GO TO QUESTION M22 ☐ No → GO TO NEXT PAGE
M22. **[IF YES TO QUESTION M21]:** Please **either:** a. describe this shift. If you need additional space, use the 'comments' section (Item F8) on Page 20; **or:** b. send us an example of your mine's shift schedule(s) and check the → appropriate box(es).	______________ ______________ ☐ Schedule enclosed	______________ ______________ ______________ ______________ ______________ ______________ ______________ ______________ ______________ ______________ ☐ Schedule enclosed	______________ ______________ ☐ Schedule enclosed

INDEPENDENT CONTRACTOR EMPLOYEES

The next series of questions asks about the mine's use of independent contractor employees for various activities. Take special note of these two definitions:

- **Independent contractor** means "any person, partnership, corporation, firm, association, subsidiary of a corporation, or other organization that contracts to perform services or construction of a mine."
- **REPORTING WEEK** is your specific 7-day payroll period that includes the date shown in the box on Page 1. The number of independent contractors you report should be for that week only.

M23. In the REPORTING WEEK, did this mining operation use independent contractor employees to do . . .	**M24**. How many independent contractor employees did you use for this activity during the REPORTING WEEK?	**M25**. How many total hours did independent contractor employees work in this activity during the REPORTING WEEK?
a. Mine development, including shaft and slope sinking, or "driving a decline"? ☐ Yes → ☐ No	a. ________ → # of Contractor employees	a. ________ Contractor hours
b. Construction or reconstruction of mine facilities, including building or rebuilding preparation plants and mining equipment, maintenance, and building additions to existing facilities? ☐ Yes → ☐ No	b. ________ → # of Contractor employees	b. ________ Contractor hours

INDEPENDENT CONTRACTOR EMPLOYEES (continued)

M23. In the REPORTING WEEK, did this mining operation use independent contractor employees to do . . .	**M24**. How many independent contractor employees did you use for this activity during the REPORTING WEEK?	**M25**. How many total hours did independent contractor employees work in this activity during the REPORTING WEEK?
c. Demolition of mine facilities? ☐ Yes → ☐ No	c. ________ → # of Contractor employees	c. ________ Contractor hours
d. Construction of dams? ☐ Yes → ☐ No	d. ________ → # of Contractor employees	d. ________ Contractor hours
e. Excavation or earthmoving activities involving mobile equipment? ☐ Yes → ☐ No	e. ________ → # of Contractor employees	e. ________ Contractor hours
f. Equipment installation, such as crushers and mills? ☐ Yes → ☐ No	f. → # of Contractor employees	f. ________ Contractor hours

INDEPENDENT CONTRACTOR EMPLOYEES (continued)

M23. In the REPORTING WEEK, did this mining operation use independent contractor employees to do . . .	**M24**. How many independent contractor employees did you use for this activity during the REPORTING WEEK?	**M25**. How many total hours did independent contractor employees work in this activity during the REPORTING WEEK?
g. Equipment service or repair of equipment on mine property for a period exceeding 5 consecutive days at a particular mine? ☐ Yes ⟶ ☐ No	g. ______________ ➔ # of Contractor employees	g. ______________ Contractor hours
h. Material handling such as hauling of coal, ore, or refuse within mine property? (Only include material handling conducted primarily on mine property.) ☐ Yes ⟶ ☐ No	h. ______________ ➔ # of Contractor employees	h. ______________ Contractor hours
i. Drilling and blasting? ☐ Yes ⟶ ☐ No	i. ➔ # of Contractor employees	i. ______________ Contractor hours

10

INDEPENDENT CONTRACTOR EMPLOYEES (continued)

M23. In the REPORTING WEEK, did this mining operation use independent contractor employees to do. . .	**M24**. How many independent contractor employees did you use for this activity during the REPORTING WEEK?	**M25**. How many total hours did independent contractor employees work in this activity during the REPORTING WEEK?
j. Production support work (belt moves, building stoppings, installing roof support, moving a longwall, relocating a large piece of mining equipment (including dismantling and reassembly), surveying, engineering work, etc.)? ☐ Yes → ☐ No	j. ________ ➔ # of Contractor employees	j. ________ Contractor hours
k. Mineral extraction? ☐ Yes → ☐ No	k. ________ ➔ # of Contractor employees	k. ________ Contractor hours
l. Any other types of work? ☐ Yes → ☐ No ➔ GO TO NEXT PAGE	l. ➔ # of Contractor employees	l. ________ Contractor hours

Please describe this activity:

____

____

____

____

SAFETY, COMMUNICATION, AND RESCUE MEASURES

M26. Which of the following types of communication devices and systems does this mine currently use? **[Please check ALL that apply.]**

- ☐ Dedicated telephones
- ☐ Mine page phones
- ☐ Trolley phones
- ☐ Shaft or hoist phones
- ☐ Cell phones
- ☐ Voice Over Internet Protocol (VOIP) phones
- ☐ Handheld two-way radios
- ☐ Wireless paging devices
- ☐ Leaky feeder communications system (not running a PED)
- ☐ Personal emergency device (PED) cap lamp/pager
- ☐ Through-the-Earth (TTE) technology (other than a PED, e.g., Flexalert or TeleMag)
- ☐ Inductive coupled radios
- ☐ Ethernet
- ☐ TRACKER Tagging System
- ☐ Longwall face communication systems
- ☐ None of the above
- ☐ Other **(Please specify)**:

____

____

M27. Which of the following personal locators, trackers, or other devices does this mine currently use to make miners more visible and to support escape in limited visibility situations? **[Please check ALL that apply.]**

- ☐ Electronic or computerized tagging or tracking systems/devices
- ☐ Tag boards (check-in/check-out)
- ☐ Reflective vests/clothing
- ☐ Chemical light sticks
- ☐ Lighted vests
- ☐ Laser lights/pointers
- ☐ Strobe lights
- ☐ None of the above
- ☐ Other **(Please specify)**:

____

____

M28. Which of the following methods does this mine use for emergency incident early warning systems for miners? **[Please check ALL that apply.]**

- ☐ Stench gas
- ☐ Audible systems
- ☐ Visual systems (lights)
- ☐ Pager phones
- ☐ Telephones
- ☐ Messengers
- ☐ Electronic personal communication systems (e.g., PED)
- ☐ None of the above
- ☐ Other **(Please specify)**:

____

____

SAFETY, COMMUNICATION, AND RESCUE MEASURES (continued)

M29. Does this mine have its own mine rescue team?

- ☐ Yes ➔ **[IF YES]** How many individual members are assigned to the mine's rescue team?

  ____

  Record total members above and **Go to Question M30**

- ☐ No ➔ **[IF NO]** Go to NOTE box in next column

M30. How frequently is team training conducted for the members of the mine rescue team? **[Please check one.]**

- ☐ Less than once a year
- ☐ Annually
- ☐ Less than once a month
- ☐ Once a month
- ☐ Once every 2 weeks
- ☐ Once a week
- ☐ Some other time interval **(Please specify):**

____

____

NOTE – The next two questions (M31 and M32) apply only to underground mines. Surface mine respondents should skip to the next section (Employee Selection Instructions).

M31. Which of the following types of emergency equipment or emergency supplies does this mine currently rely on for miner safety? **[Please check ALL that apply.]**

- ☐ Belt-worn self-contained-self-rescuers (SCSRs)
- ☐ Cached self-contained-self-rescuers (SCSRs)
- ☐ Filter self-rescuers (FSRs) (e.g., W65)
- ☐ Stationary emergency refuge chambers
- ☐ Mobile emergency refuge chambers
- ☐ Sealing materials
- ☐ Cached water/food supplies
- ☐ First aid kits
- ☐ Defibrillator
- ☐ None of the above
- ☐ Other **(Please specify)**:

____

____

M32. Which of the following types of escapeway aids does this mine use? **[Please check ALL that apply.]**

- ☐ Lifelines
- ☐ Directional lifelines
- ☐ Signage
- ☐ Colored reflectors
- ☐ Lighting
- ☐ Strobe lights
- ☐ None of the above
- ☐ Other **(Please specify)**:

____

____

Mine ID Number:	**Reporting Week:**	**Estimated Number of Employees:**
«MineIDNumber»	**«ReportingWeek»**	**Between «EstimatedEmpMin» and «EstimatedEmpMax»**
Mine Name:	**Start With Number:**	**Take Every Number:**
«MineName»	**«StartWithNumber»**	**«TakeEveryNumber»**

EMPLOYEE SELECTION INSTRUCTIONS

The Employee Questions ask you to report the demographic characteristics of a sample of your employees. This page contains instructions for selecting the sample of employees to include in the Employee Questions. (Please DO NOT include independent contractor employees in this part of the questionnaire, and DO NOT include any mine employee who was not at work during the REPORTING WEEK.)

Step 1. Print or copy a list from your files of the names and job titles of all mine employees who worked during the REPORTING WEEK (which includes the date shown in the box above) for the mining operation associated with the Mine ID and name (shown above). (Hourly and salaried employees can be combined, or listed separately, on the REPORTING WEEK list.)

Step 2. Sequentially number the salaried and hourly employees on your list, starting with the first name on the top of the list, e.g., 1, 2, 3, … This number will be the *employee sequence number.* [NOTE: The sequential numbering may be done by computer.]

Step 3. Record the total number of employees who worked during the REPORTING WEEK.

➔ ______ = **TOTAL NUMBER WHO WORKED DURING REPORTING WEEK**

If this total number is . . .

... **equal to 0**, *[not applicable]* **Go to Page 19**.	... **fewer than 30**, *[all are to be included]* Please circle every one of the numbers you have recorded in Step 2, and **Go to next page**.	... **30 or more**, *[select a sample]* **Continue with Step 4**

Step 4. Quarterly reports indicate that this mine employs the Estimated Number of Employees shown in the box above. Does the number of employees recorded in Step 3 fall within the range of Estimated Number of Employees shown in the box above?

☐ Yes ➔ **Continue with Step 5**.

☐ No ➔ **If estimated number is incorrect, please call 1-888-814-4707 for assistance**. This is the toll-free number for Westat, the survey contractor.

Step 5. In these next steps, you will circle the *employee sequence numbers* for employees to be selected for the survey. To do this, you will use the **Start With Number** and **Take Every Number** printed in the box above.

Step 6. First, circle the *employee sequence number* that matches the **Start With Number** in the box above. This is the first employee selected for the survey.

Step 7. Next, start counting the *employee sequence numbers*, beginning with the sequence number after the one just circled. Count until you reach the **Take Every Number** listed in the box above. Circle that *employee sequence number*. This is the next selection.

Step 8. Repeat Step 7 until you come to the end of your employee list.

> EXAMPLE: If total employees = 49, Start With Number = 2, and Take Every Number = 3, then you would circle the following employee sequence numbers: 2, 5, 8, 11, 14, 17, 20, 23, 26, 29, 32, 35, 38, 41, 44, 47.

Step 9. Refer to the detailed instructions on the next page and record the sequence numbers you have circled in the first column of the Employee Questions.

INSTRUCTIONS FOR EMPLOYEE QUESTIONS

This section provides you with an item-by-item explanation for the Employee Questions. Please read these instructions carefully before completing the fold-out answer form on Page 17, or Employee Question screens on web version.

E1. Employee sequence number

This is the circled number from your employee roster list.

- If there are **fewer than 30** employees who worked during the REPORTING WEEK at your mine, all employees are included in the survey. Write each circled number on a separate line and provide the information corresponding to that employee.
- If there are **30 or more** employees who worked during the REPORTING WEEK at your mine, according to Steps 5-9 of the selection instructions, you have circled and recorded the sequence numbers of the employees being sampled. For example, if John Doe is fifth on your list, and he is selected to be included in the employee survey, then write "5" as the employee sequence number, and provide the information corresponding to that employee.

E2. Employee's regular job title

Regular job title means the title that specifies the employee's current position in the mine structure (e.g., manager). This information may be in an employee's personnel file or in the payroll system.

E3. Months or years of experience in this job title

Experience in this job title means the number of months or years that this employee has had his or her current job title. Report months only for those employees with less than 1 year of experience.

- **Months (MM) Column**: If the employee has been in the current job title **less than a year** at this mine, please **record** the number of **months** in the month's column. Round partial months up if one- half or more.
- **Years (YY) Column**: If the employee has been in the current job title **1 year or more**, please **record** number of **years** in the year's column. Round partial years up if one-half or more.

E4. Months or years of experience in this mine

Experience in this mine means the number of months or years that this employee has been working at this mine, from the time that the mine hired him or her. Report months only for those employees with less than 1 year of experience.

- **Months (MM) Column**: If the employee has worked for the mine **less than a year**, please **record** the number of **months** in the month's column. Round partial months up if one-half or more.
- **Years (YY) Column**: If the employee has worked for the mine **1 year or more**, please **record** number of **years** in the year's column. Round partial years up if one-half or more.

E5. Months or years of total mining experience

Total mining experience means the number of months or years that an employee has been employed in the mining industry overall. Please include years spent at other mining companies and at other ranks or job titles. Report months only for those employees with less than 1 year of experience.

- **Months (MM) Column**: If the employee has worked in the mining industry **less than a year**, please **record** the number of **months** in the month's column. Round partial months up if one-half or more.
- **Years (YY) Column**: If the employee has worked in the mining industry **1 year or more**, please **record** number of **years** in the year's column. Round partial years up if one-half or more.

E6. Number of hours worked during the REPORTING WEEK

Number of hours worked means the number of hours for which the employee was paid conducting mining business during the REPORTING WEEK. The REPORTING WEEK includes the date shown in the box at the top of Page 1 or Page 14.

- **Do not include** vacation time, sick time, medical leave, or other time spent on non-work activities.

This information may be found in the employee's time reporting records.

E7. Employee's primary work location

Primary work location means the location where this employee worked the most hours in the REPORTING WEEK.

- Check ONLY one location.

Location categories (listed on the answer form/screen) are adapted from MSHA's Quarterly Mine Employment and Coal Production Report (MSHA Form 7000-2) with the exception that the following operational subunits have been combined into one work location: Auger, Culm Bank or Refuse Pile. This information may be found in the same employee work records that are used as source data to compile the MSHA quarterly report.

E8. Gender

Please specify by checking if the employee is male (M) or female (F). This information may be found in the employee's personnel file.

E9. Hispanic or Latino

Please specify ethnicity by checking whether or not the employee is Hispanic or Latino. Note that an additional question on the employee's race follows in the next question.
This information may be found in the employee's personnel file.

E10. Race

Please specify the employee's race by checking one or more categories.

E11. Year of birth

Please record the employee's year (YY) of birth. Use two digits for year (e.g., 1980 is "80").

This information may be found in the employee's personnel file.

E12. Highest level of education completed

Please check one category for *highest level of education completed*. This means the last grade that the employee completed.

This information is most likely included in the employee's personnel file.

Employee Questions

E1.	E2.	E3.		E4.		E5.		E6.	E7.									E8.		E9.		E10.					E11.	E12.				
		Months **OR** Years of Experience							EMPLOYEE'S PRIMARY WORK LOCATION Where He/She Worked the Most Hours in the REPORTING WEEK (Check ONLY One)									Gender		Hispanic or Latino		Race (Check One or More)					Year of Birth	Highest Level of Education Completed (Check ONLY One)				
		In this Job Title		In this Mine		Total Mining																										
Employee Sequence Number (from employee roster list)	Employee's Regular Job Title	IF LESS THAN A YEAR, Enter Number of **Months**	IF ONE YEAR OR MORE, Enter Number of **Years**	IF LESS THAN A YEAR, Enter Number of **Months**	IF ONE YEAR OR MORE, Enter Number of **Years**	IF LESS THAN A YEAR, Enter Number of **Months**	IF ONE YEAR OR MORE, Enter Number of **Years**	Number of Hours Worked during the REPORTING WEEK	**Underground Mine:** Underground	**Underground Mine:** Surface Shops, Yards, etc.	**Surface Mine** (including associated shops and yards): Strip, Open Pit, or Quarry	**Surface Mine** (including associated shops and yards): Auger, Culm Bank or Refuse Pile (Coal Mine Only)	**Surface Mine** (including associated shops and yards): Dredge	**Surface Mine** (including associated shops and yards): Other Surface Mining (Metal/Nonmetal only)	**Independent Shops or Yards**	**Mill Operations, Preparation Plants, or Breakers** (include associated shops and yards)	**Office** (professional and clerical employees at the mine or plant working in an office)	M	F	Yes	No	American Indian or Alaska Native	Asian	Black or African American	Native Hawaiian or Other Pacific Islander	White	19YY	Less than 9th grade	9th-12th grade (no diploma)	HS Graduate or Equivalent (GED)	Some College, Associate Degree, or Technical School	Bachelor's Degree or beyond
		MM	YY	MM	YY	MM	YY																									
		MM	YY	MM	YY	MM	YY																									
		MM	YY	MM	YY	MM	YY																									
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Employee Questions

E1.	E2.	E3.		E4.		E5.		E6.	E7.									E8.		E9.		E10.					E11.	E12.				
		Months **OR** Years of Experience							EMPLOYEE'S PRIMARY WORK LOCATION Where He/She Worked the Most Hours in the REPORTING WEEK (Check ONLY One)									Gender		Hispanic or Latino		Race (Check One or More)					Year of Birth	Highest Level of Education Completed (Check ONLY One)				
		In this Job Title		In this Mine		Total Mining																										
Employee Sequence Number (from employee roster list)	Employee's Regular Job Title	IF LESS THAN A YEAR, Enter Number of **Months**	IF ONE YEAR OR MORE, Enter Number of **Years**	IF LESS THAN A YEAR, Enter Number of **Months**	IF ONE YEAR OR MORE, Enter Number of **Years**	IF LESS THAN A YEAR, Enter Number of **Months**	IF ONE YEAR OR MORE, Enter Number of **Years**	Number of Hours Worked during the REPORTING WEEK	**Underground Mine:** Underground	**Underground Mine:** Surface Shops, Yards, etc.	**Surface Mine** (including associated shops and yards): Strip, Open Pit, or Quarry	**Surface Mine** (including associated shops and yards): Auger, Culm Bank or Refuse Pile (Coal Mine Only)	**Surface Mine** (including associated shops and yards): Dredge	**Surface Mine** (including associated shops and yards): Other Surface Mining (Metal/ Nonmetal only)	**Independent Shops or Yards**	**Mill Operations, Preparation Plants, or Breakers** (include associated shops and yards)	**Office** (professional and clerical employees at the mine or plant working in an office)	M	F	Yes	No	American Indian or Alaska Native	Asian	Black or African American	Native Hawaiian or Other Pacific Islander	White	19YY	Less than 9th grade	9th-12th grade (no diploma)	HS Graduate or Equivalent (GED)	Some College, Associate Degree, or Technical School	Bachelor's Degree or beyond
		MM	YY	MM	YY	MM	YY																									
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		MM	YY	MM	YY	MM	YY																									

FINAL QUESTIONS AND COMMENTS

F1. In the REPORTING WEEK, were there any events or circumstances that would make what you have reported unusual (e.g., severe weather conditions, trouble in production, a labor strike, etc.)?

☐ Yes ➔ **Go to Question F2**

☐ No ➔ **Go to Question F3**

F2. **[IF YES TO Question F1]:** Please specify the unusual events:

____

____

____

F3. What is today's date? |__|__| |__|__| |__|__|__|__|

M M D D Y Y Y Y

F4. Please make a copy of this completed questionnaire and your list of sampled employees (keep these on file for 60 days) in case we need to contact you for clarification.

F5. Please provide the company representative to be contacted regarding the completion of the questionnaire:

Name: ____

Title: ____

Telephone: (   ) ________________________

F6. Reminder: If you so indicated in question M22, please enclose an example of your mine schedule with your completed questionnaire.

F7. Please mail this completed questionnaire in the provided business reply envelope to the survey contractor: **Westat, Room TC-1046F, 1650 Research Boulevard, Rockville, MD 20850-3195.**

Please record any comments on the next page.

FINAL QUESTIONS AND COMMENTS (continued)

F8. Do you have any comments, or is there any other information you can provide that may help us understand the answers you provided? (Please include question numbers for comments or explanations related to specific responses.)

Thank you for your participation in this survey!

National Institute for Occupational Safety and Health

NIOSH

Delivering on the Nation's promise:
Safety and health at work for all people
through research and prevention

If you have any questions regarding the
National Survey of the Mining Population, please contact:

Linda J. McWilliams
Project Director
NIOSH, Pittsburgh Research Laboratory
P.O. Box 18070
626 Cochrans Mill Road
Building 01
Pittsburgh, PA 15236

Telephone: (412) 386-6116
Fax: (412) 386-6780
E-mail: LMcWilliams@cdc.gov

http://www.cdc.gov/niosh/mining/statistics/survey.htm

Appendix B. Questions and Answers Brochure

Why is this survey being done?

The mission of the National Institute for Occupational Safety and Health (NIOSH) is working to improve the safety and health of American workers. As part of this effort, NIOSH/Pittsburgh Research Laboratory (PRL) is collecting demographic and other data on the mining industry.

Since 1986, there has been little research on the demographics of the mining labor force, such as age, gender, job title, languages used, educational attainment, race, ethnicity, and years of mining experience. These data are needed to understand the risk of work-related injuries, disease, and fatalities and to customize safety and health interventions for specific groups of the mining industry. These data can also be used to learn more about the underlying causes of work-related incidents and to identify ways to reduce their occurrence.

NIOSH/PRL is sponsoring this survey of mining operations and their employees to fill this data gap. Our main objectives are to:

- collect basic information about mining operations;
- establish the demographic and occupational characteristics of mine operator employees for each mining commodity (i.e., coal, metal, nonmetal, stone, and sand and gravel); and
- estimate the number of independent contractor employees used by mining operations and their occupational characteristics.

What will the mining industry and my mine get out of this survey?

The ultimate goal of the survey is to minimize and prevent work-related injuries and diseases that harm miners and reduce productivity. NIOSH will use the information you provide to clarify safety and health issues and calculate injury rates for various occupations. For example, we now know how many electricians are reported as injured in mine accidents, but we don't know how many total electricians work in the mining industry, in order to calculate their injury rates. Once the survey is completed, such rates will be available, and NIOSH will send you a copy of the final report.

What data will be collected?

There are two sets of data being collected:

- The **mine questions** include items about the mining operation, its use of independent contractors, safety, and communication measures.
- The **employee questions** include demographic and occupational questions about individual mine employees.

It is important that you complete ***both*** parts of the survey. You have the option of completing either the survey questionnaire booklet or an Internet survey questionnaire. Both versions ask the same questions. Instructions to access the Internet questionnaire are attached to the cover letter included in this mailing.

Am I required to participate?

Your participation is voluntary and you may refuse to answer any question for any reason. However, the participation of each selected mining operation is vital to the success of the survey.

Why was my mining operation chosen?

Your mining operation was randomly selected from a list of all mining operations nationwide. The sample must represent the diversity of mining operations across the Nation. The information you provide is essential to obtain an accurate picture of the mining industry.

Who will see my responses?

Only NIOSH researchers, and researchers from Westat, NIOSH's data collection contractor, will see your responses. Both organizations are firmly committed to protecting the survey data and will not release this information unless compelled by law. The answers from all participating mines will be published only as summarized data so that no single company or individual employee can be identified.

Is it appropriate for me to release information about employees who work here?

You will not be reporting the names or other identifying information of individual employees. The data you provide cannot be linked to any of your individual employees.

Appendix C. MSHA Form 7000-2: Quarterly Mine Employment and Coal Production Report

Quarterly Mine Employment
and Coal Production Report
(SEE INSTRUCTIONS ON REVERSE SIDE OF COPY 2)

DOL - MSHA - PEIR - OIEI
P.O. Box 25367
Denver, Colorado 80225 - 0367

For Quarter Year

Date Report Completed

Mo. Day Yr.

Mail Before

1. Persons Working, Employee-Hours, and Coal Production

(1) Operation Sub Unit Code(s) previously reported:		Code	(2) Average number of persons working during quarter	(3) Total employee hours worked during the quarter	(4) Production of clean coal during quarter, (short tons)
Underground Mine	Underground	01			
	Surface Shops, Yards, etc.	02			
Surface Mine	Strip, Open Pit, or Quarry	03			
(including associated shops and yards)	Auger (Coal Mine Only)	04			
	Culm Bank or Refuse Pile (Coal Mine Only)	05			
	Dredge	06			
	Other Surface Mining (Metal/Nonmetal Only)	12			
Independent Shops or Yards		17			
Mill Operations, Preparation Plants, or Breakers (include associated shops and yards)		30			
Office (professional and clerical employees at the mine or plant working in an office)		99			

2. Other Reportable Data

How many MSHA reportable injuries or illnesses did you have this quarter?

Person to be contacted regarding this report: Name

Title

Tel. No. ( ) -
area code

MSHA Form 7000-2, July 97, (revised)

OMB Number 1219-0007; Approval Expires Apri 30, 2011

Check here if this report is being submitted by a contractor ☐

If any information below is incorrect, please enter correct information here:

County:

Operation Name:

Operating Company Name and Mailing Address:

County

MSHA ID Number

Contractor ID

Operation Name

Operating Company Name and Mailing Address

Copy 1 - Return to MSHA (Denver)

Quarterly Mine Employment and Coal Production Report

U.S. Department of Labor
Mine Safety and Health Administration

OBM Control Number 1219-0007; Approval Expires April 30, 2011

READ

This report is required by law (30 U.S.C. subsection 813; 30 C.F.R. Part 50). Failure to report may result in the issuance of a citation or order under 30 U.S.C. subsection 814 to an operator of a coal or other mine, the assessment of a civil penalty against an operator of a coal or other mine under 30 U.S.C. subsection 820(a), and the institution of a civil action under 30 U.S. C. subsection 818. An individual who knowingly makes a false statement in any report shall, upon conviction, be punished by a fine of not more than $10,000 or by imprisonment for not more than 5 years, or both, under 30 U.S.C. subsection 820(f). Whoever, in any matter within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals or covers up by any trick scheme, or device, a material fact, or makes or uses any false writing or document knowing the same to contain any false, fictitous or fraudulent statement or entry, shall be fined under 18 U. S. C. or imprisioned not more than five years, or both, under 18 U. S. C. subsection 1001.

INSTRUCTIONS

Important: (INSTRUCTIONS)

This form must be completed and mailed or faxed within 15 days after the end of each calendar quarter.

1. Fill out this form as completely as possible and return Copy 1 of this report to:
   MSHA
   PEIR - Office of Injury and Employment Information **OR** You may FAX Copy 1 to Fax # 1- 888 - 231 - 5515
   P.O. BOX 25367
   Denver, CO 80225-0367
2. If it is necessary to make any address changes, indicate correct information on this form.
3. When pre-addressed, this form is only for the operation with I. D. number as shown. Do not use for any other operation.
4. ***Sand and Gravel*** operators report employment data under code 03 or 06 as appropriate, except for data on office workers which should be reported under code 99.
5. All mine operators and independent contractors reporting as required by 30 C.F.R. Part 50, should show persons working and employee hours worked; those producing coal should also show production date.
6. ***Independent Contractors*** should complete quarterly only **one** form for activities at all coal locations, and one form for activities at metal and nonmetal locations.

READ

The public reporting burden for this collection of Information is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing date sources, gathering and maintaining the date needed, and completing and reviewing the collection of Information. Send comments regarding this estimated response time or any other aspect of this collection of information, including suggestions for reducing this burden, to Mine Safety and Health Administration, U.S. Department of Labor, 1100 Wilson Boulevard, Arlington, VA 22209-3939.

Persons are not required to respond to this collection of information unless this form displays a currently valid OMB control number.

MSHA Form 7000-2, July 97 (revised)

Appendix D. Standard Industrial Classification (SIC) for Active Mines in 2007

Coal Mining Sector

- Anthracite Coal
- Bituminous Coal

Metal Mining Sector

- Alumina (Mill)
- Aluminum Ore
- Beryl
- Chromite
- Copper Ore
- Gold (Lode and Placer)
- Iron Ore
- Lead and/or Zinc Ore
- Manganese
- Metal Ores, NEC
- Molybdenum
- Platinum Group
- Rare Earths
- Silver Ores
- Titanium
- Uranium
- Uranium – Vanadium Ores
- Vanadium
- Zircon

Nonmetal Mining Sector

- Aplite
- Barite
- Boron Materials
- Brucite
- Chemical and Fertilizer, NEC
- Clay (Common)
- Clay (Fire)
- Clay, Ceramic and Refractory, NEC
- Feldspar
- Fluorspar
- Gemstones
- Gilsonite
- Gypsum
- Kyanite

Nonmetal Mining Sector (Cont.)

- Leonardite
- Magnesite
- Mica
- Nonmetallic Minerals, NEC
- Oil Sand
- Oil Shale
- Perlite
- Phosphate Rock
- Pigment Mineral
- Potash
- Potash, Soda, & Borate Minerals, NEC
- Pumice
- Salt (Evaporated)
- Salt (Rock)
- Shale (Common)
- Sodium Compounds
- Talc, Soapstone, & Pyrophyllite
- Trona
- Vermiculite

Stone Mining Sector

- Cement
- Granite (Crushed & Broken)
- Granite (Dimension)
- Lime
- Limestone (Crushed & Broken)
- Limestone (Dimension)
- Marble (Crushed & Broken)
- Marble (Dimension)
- Sandstone (Crushed & Broken)
- Sandstone (Dimension)
- Slate (Crushed & Broken)
- Slate (Dimension)
- Stone, Crushed & Broken, NEC
- Stone, Dimension, NEC
- Traprock (Crushed & Broken)
- Traprock (Dimension)

Sand and Gravel Mining Sector

- Sand and Gravel

Abbreviation: NEC, not elsewhere classified

Appendix E. Stratification and Sample Size Guidelines

Stratification

The cum $\sqrt{f}$ rule is often suggested for use in forming strata for surveys of businesses, which typically have a large number of small businesses with very few employees and a small number of large businesses with quite substantial payrolls [Cochran 1977]. Using this approach, strata that have approximately equal sizes in terms of the square root of the size measure are established. The cum $\sqrt{f}$ rule was used in determining the initial size-based strata for each mining sector with an assumption of about 4–5 strata per sector for underground mines and for surface mines. Except for sand and gravel mines, the large mines account for 25 percent or more of total employment. These initial stratum definitions for each commodity varied somewhat across mining sectors but were similar.

The next step in stratum formation was to recognize that data from the five mining sectors would be combined to study mining as a whole. Using common definitions for strata across the five sectors facilitated these combined analyses. The initial stratum definitions were compared to determine a common stratification approach. The stratum definitions that met the needs for all five commodities were formed by the cross of underground versus surface mines with these size groupings of employees: 1–9, 10–25, 26–50, 51–75, 76–100, 101–250, and 251 and up.

Sample Size

To determine the stratum sample sizes, the precision of percentage estimates under various sample sizes was considered. Table E-1 presents the half-length of confidence intervals around an estimated percentage $\hat{P}$ under various sample size and design effects and assuming large population sizes. For this table, the confidence interval was approximated for design purposes as:

$$\hat{P} \pm z_{1-\alpha} \sqrt{Var\ (\hat{P})} \tag{1}$$

Here $z_{1-\alpha}$ is the value of the critical point x at which the normal cumulative distribution function equals 1-α, and $Var\ (\hat{P})$ is the variance of $\hat{P}$. The half-length HL is:

$$HL = z_{1-\alpha} \sqrt{Var\ (\hat{P})} \tag{2}$$

That is, $\hat{P}$ can be expected to fall within the range [P–HL, P+HL] with 95 percent confidence for the indicated sample sizes.

To determine these half-lengths of confidence intervals, there is a need to estimate the variance of the estimated percentage $\hat{P}$. Ignoring finite population correction factors, Table E-1 models the variance for an estimated percentage $\hat{P}$ as:

$$Var\ (\hat{P}) = \frac{P\,(100\ -\ P\ )}{n} DEFF \qquad (3)$$

where n is the sample size, P is the percentage being estimated, and *DEFF* is the design effect. The design effect for a survey estimate is defined to be the ratio of the statistic under the actual design divided by the variance that would have been achieved from a simple random sample of the same size. The design effect represents the cumulative effect of design components such as stratification, unequal weighting, and clustering, and varies with each design. The design effects for this survey were estimated to be about 1.00 for mine-level and employee-level estimates within strata. Crosscutting estimates were likely to have larger design effects, particularly for employee-level estimates. The design effect differs from 1.00 for the crosscutting estimates due to the variation in sampling rates used across strata. Fortunately, these crosscutting estimates often have large sampler sizes due to combining samples across strata.

Sample sizes were set with the guideline that the precision for stratum estimates was constrained as that shown for sample sizes of 100 in Table E-1. Some mine strata have very small population sizes and some mining sectors are small overall. In such situations, the variance as given in equation (3) is reduced by the factor $(N - n)/(N - 1)$, where n is the sample size and N is the population size. Rather than create versions of Table E-1 for all possible population sizes, finite-population-corrected (*fpc*) sample sizes were developed. An actual sample size of n for a population of size N is equivalent to the precision achieved with a sample size of $n' = \frac{n(N-1)}{N-n}$ from a population so large that fpc effects are ignorable. Initial sample sizes were set for each stratum so that the finite-population-corrected sample size was about 100 and then inflated to account for a projected 80 percent response rate. These initial sample sizes were then adjusted to prevent excessive variations in the sampling rates across strata for mines and for employees.

Besides the number of mines selected, the employee sample size is affected by the eligibility and response rates for mines and the average number of employees sampled per mine. The average number of employees sampled per mine would be about 20 except for the smallest stratum where approximately 5 employees would tend to be sampled. It was assumed that 80 percent of all eligible mines would respond, providing both mine-level and employee-level data. For sample design purposes, the assumption was made that a variable percentage of mines would be eligible for the survey, depending upon employment size. An eligibility rate of 85 percent was assumed for mines with 1–9 employees. These mines are most likely to shut down operations or go out of business. An eligibility rate of 90 percent was assumed for mines with 10–50 employees, and 95 percent for mines with 51–100 employees. For very large mines with employment of more than 100, an eligibility rate of 99 percent was assumed, as they should be most stable in terms of their operations.

In designing the commodity samples, an effort was made to minimize the design effects for mine-level and employee-level analyses. In particular, the goal was to achieve design effects of 1.0 for within-stratum estimates and design effects of 2.0 or less for crosscutting estimates. Following standard practice, the design effect *DEFF* was modeled as the product of the design effect associated with unequal weighting D_w and the design effect for clustering D_c, that is $DEFF = D_w * D_c$. A simple random sample has both design effect components equal to one—therefore *DEFF*=1.

Both mine-level and employee-level estimates could potentially be subject to an unequal weighting effect greater than one, particularly for crosscutting estimates that combine data from multiple strata. The design effect for unequal weighting can be estimated as:

$$D_w = \frac{n\sum_{i=1}^{n} W_i^2}{\left(\sum_{i=1}^{n} W_i\right)^2} \tag{4}$$

where n is the total sample size and W_i is the weight for the i^{th} observation. When the weights (the inverse of the selection probabilities) are equal for all selections, $D_w = 1$. For mines, $D_w = 1$ within all strata for the proposed designs and was often only slightly greater than one across strata. For employees, $D_w = 1$ except for the two largest strata that collapsed employee size categories. These strata tended to have all mines selected with certainty, so the only way to reduce D_w was to increase the number of employees sampled per mine from 25 to 50. Adjusting the sample size for the very large mines could even out the employee-level weights within these strata and across strata. However, the increase in employee sample size also increased the burden for the mine respondent and increased the design effect for clustering.

The design effect associated with clustering measures the loss of precision of a clustered sample as compared with a simple random sample. Clustered samples tend to have less precision than simple random samples of the same size, because units within the same cluster usually are more homogeneous than units from different clusters. The design effect for clustering can be estimated as:

$$D_c = 1 + \rho(b-1) \tag{5}$$

where ρ is the intracluster correlation coefficient and b is the cluster size. Because stratified simple random sampling would be used to select mines, the mines would not be clustered (b = 1) and mine-level estimates would not be subject to a clustering effect (D_c = 1). However, multiple employees would be selected from each mine, so employee-level estimates would be subject to a design effect due to clustering. For the purpose of modeling the clustering design effect, it was assumed that variable values for ρ be based upon the size of the mine. Employees within small mines with 1 to 50 employees were expected to be more homogeneous, so a value of ρ = 5 percent was assumed. Medium size mines were assumed to be less homogeneous, so a value of ρ = 3 percent was assumed. Large mines with more than 100 employees were expected to be quite diverse, so a value of ρ = 1 percent was assumed. A value of ρ = 3 percent was assumed for estimates compiled across strata.

Table E-1. Half-Length of 95% Confidence Intervals in Percentage Points for Various Percentages Being Estimated for Domains of Various Sizes with Various Design Effects

DEFF	*P*	50	75	100	150	200	250	350	400	500
1.00	10	8	7	6	5	4	4	3	3	3
1.00	20	11	9	8	6	6	5	4	4	4
1.00	25	12	10	8	7	6	5	5	4	4
1.00	30	13	10	9	7	6	6	5	4	4
1.00	40	14	11	10	8	7	6	5	5	4
1.00	50	14	11	10	8	7	6	5	5	4
1.25	10	9	8	7	5	5	4	4	3	3
1.25	20	12	10	9	7	6	6	5	4	4
1.25	25	13	11	9	8	7	6	5	5	4
1.25	30	14	12	10	8	7	6	5	5	4
1.25	40	15	12	11	9	8	7	6	5	5
1.25	50	15	13	11	9	8	7	6	5	5
1.50	10	10	8	7	6	5	5	4	4	3
1.50	20	14	11	10	8	7	6	5	5	4
1.50	25	15	12	10	8	7	7	6	5	5
1.50	30	16	13	11	9	8	7	6	6	5
1.50	40	17	14	12	10	8	7	6	6	5
1.50	50	17	14	12	10	8	8	6	6	5
2.00	10	12	10	8	7	6	5	4	4	4
2.00	20	16	13	11	9	8	7	6	6	5
2.00	25	17	14	12	10	8	8	6	6	5
2.00	30	18	15	13	10	9	8	7	6	6
2.00	40	19	16	14	11	10	9	7	7	6
2.00	50	20	16	14	11	10	9	7	7	6
3.00	10	12	10	8	7	6	5	4	4	4
3.00	20	16	13	11	9	8	7	6	6	5
3.00	25	17	14	12	10	8	8	6	6	5
3.00	30	18	15	13	10	9	8	7	6	6
3.00	40	19	16	14	11	10	9	7	7	6
3.00	50	20	16	14	11	10	9	7	7	6

Appendix F. Sample Size Allocation Using MSHA Data from the Second Quarter of 2002

Table F-1. Sample Allocation for Underground Coal Mines

Stratum	Number of Mines	Percentage of Total Mines	Number of Employees	Percentage of Total Employees	Sample Mines	Eligibility Rate	Response Rate	Responding Eligible Mines
1–9	102	19%	461	1%	56	85%	80%	38
10–25	149	27%	2,589	7%	68	90%	80%	49
26–50	146	26%	5,206	15%	67	90%	80%	48
51–75	49	9%	3,098	9%	35	95%	80%	27
76–100	22	4%	1,917	5%	22	95%	80%	17
101–250	49	9%	8,301	24%	49	99%	80%	39
251+	34	6%	13,477	38%	34	99%	80%	27
Total	**551**	**100%**	**35,049**	**100%**	**331**			**244**

Stratum	Employees Sampled Per Mine	Total Sample Employees	Nonresponse Adjusted Mine Weight	Average Employee Weight	Mine *DEFF*	Employee D_w	Employee ρ	Employee D_c	Employee *DEFF*
1–9	5	172	2.3	2.3	1.0	1.0	5%	1.2	1.2
10–25	17	851	2.7	2.7	1.0	1.0	5%	1.8	1.8
26–50	18	860	2.7	5.4	1.0	1.0	5%	1.8	1.8
51–75	21	561	1.8	5.3	1.0	1.0	3%	1.6	1.6
76–100	22	364	1.3	5.0	1.0	1.0	3%	1.6	1.6
101–250	23	908	1.3	9.1	1.0	1.0	1%	1.2	1.3
251+	24	651	1.3	20.5	1.0	1.1	1%	1.2	1.3
Total		**4,366**			**1.1**	**1.6**	**3%**	**1.5**	**2.5**

Table F-2. Sample Allocation for Surface Coal Mines

Stratum	Number of Mines	Percentage of Total Mines	Number of Employees	Percentage of Total Employees	Sample Mines	Eligibility Rate	Response Rate	Responding Eligible Mines
1–9	518	46%	2,193	6%	101	85%	80%	69
10–25	252	23%	4,166	12%	84	90%	80%	60
26–50	188	17%	6,860	19%	75	90%	80%	54
51–75	58	5%	3,500	10%	36	95%	80%	27
76–100	24	2%	2,068	6%	20	95%	80%	15
101–250	52	5%	8,114	23%	52	99%	80%	41
251+	23	2%	8,823	25%	23	99%	80%	18
Total	**1,115**	**100%**	**35,724**	**100%**	**391**			**285**

Stratum	Employees Sampled Per Mine	Total Sample Employees	Nonresponse Adjusted Mine Weight	Average Employee Weight	Mine *DEFF*	Employee D_w	Employee ρ	Employee D_c	Employee *DEFF*
1–9	4	291	6.4	6.4	1.0	1.0	5%	1.2	1.2
10–25	17	1,000	3.8	3.8	1.0	1.0	5%	1.8	1.8
26–50	18	985	3.1	6.3	1.0	1.0	5%	1.9	1.9
51–-75	20	550	2.0	6.0	1.0	1.0	3%	1.6	1.6
76–100	22	327	1.5	6.0	1.0	1.0	3%	1.6	1.6
101–250	23	935	1.3	8.6	1.0	1.1	1%	1.2	1.3
251+	25	461	1.3	19.0	1.0	1.1	1%	1.2	1.4
Total		**4,549**			**1.3**	**1.4**	**5%**	**1.7**	**2.4**

Table F-3. Sample Allocation for Underground Metal Mines

Stratum	Number of Mines	Percentage of Total Mines	Number of Employees	Percentage of Total Employees	Sample Mines	Eligibility Rate	Response Rate	Responding Eligible Mines
1–9	18	35%	92	2%	18	85%	80%	12
10–25	7	14%	123	2%	7	90%	80%	5
26–50	4	8%	171	3%	4	90%	80%	3
51–75	2	4%	125	2%	2	95%	80%	2
76–100	3	6%	264	5%	3	95%	80%	2
101–250	12	24%	1,844	36%	12	99%	80%	10
251+	5	10%	2,476	49%	5	99%	80%	4
Total	**51**	**100%**	**5,095**	**100%**	**51**			**37**

Stratum	Employees Sampled Per Mine	Total Sample Employees	Nonresponse Adjusted Mine Weight	Average Employee Weight	Mine *DEFF*	Employee D_w	Employee ρ	Employee D_c	Employee *DEFF*
1–9	5	63	1.3	1.3	1.0	1.0	5%	1.2	1.2
10–25	18	89	1.3	1.3	1.0	1.0	5%	1.8	1.8
26–50	21	62	1.3	2.5	1.0	1.0	5%	2.0	2.0
51–75	21	32	1.3	3.8	1.0	1.0	3%	1.6	1.6
76–100	22	50	1.3	5.0	1.0	1.0	3%	1.6	1.6
101–250	23	222	1.3	8.2	1.0	1.1	1%	1.2	1.3
251+	24	96	1.3	25.4	1.0	1.4	1%	1.2	1.7
Total		**613**			**1.0**	**2.5**	**3%**	**1.5**	**3.7**

Table F-4. Sample Allocation for Surface Metal Mines

Stratum	Number of Mines	Percentage of Total Mines	Number of Employees	Percentage of Total Employees	Sample Mines	Eligibility Rate	Response Rate	Responding Eligible Mines
1–9	54	34%	235	1%	54	85%	80%	37
10–25	27	17%	438	2%	27	90%	80%	19
26–50	10	6%	356	2%	10	90%	80%	7
51–75	9	6%	591	3%	9	95%	80%	7
76–100	12	7%	1,094	5%	12	95%	80%	9
101–250	19	12%	2,959	13%	19	99%	80%	15
251+	30	19%	17,703	76%	30	99%	80%	24
Total	**161**	**100%**	**23,376**	**100%**	**161**			**118**

Stratum	Employees Sampled Per Mine	Total Sample Employees	Nonresponse Adjusted Mine Weight	Average Employee Weight	Mine *DEFF*	Employee D_w	Employee ρ	Employee D_c	Employee *DEFF*
1–9	4	160	1.3	1.3	1.0	1.0	5%	1.2	1.2
10–25	16	315	1.3	1.3	1.0	1.0	5%	1.8	1.8
26–50	18	128	1.3	2.5	1.0	1.0	5%	1.8	1.8
51–75	22	150	1.3	3.8	1.0	1.0	3%	1.6	1.6
76–100	23	208	1.3	5.0	1.0	1.0	3%	1.7	1.7
101–250	23	344	1.3	8.5	1.0	1.1	1%	1.2	1.3
251+	24	581	1.3	30.2	1.0	1.4	1%	1.2	1.7
Total		**1,886**			**1.0**	**2.7**	**3%**	**1.4**	**3.9**

Table F-5. Sample Allocation for Underground Nonmetal Mines

Stratum	Number of Mines	Percentage of Total Mines	Number of Employees	Percentage of Total Employees	Sample Mines	Eligibility Rate	Response Rate	Responding Eligible Mines
1–9	12	29%	50	1%	12	85%	80%	8
10–25	2	5%	38	1%	2	90%	80%	1
26–50	8	20%	290	6%	8	90%	80%	6
51–75	4	10%	232	5%	4	95%	80%	3
76–100	1	2%	80	2%	1	95%	80%	1
101–250	9	22%	1,634	34%	9	99%	80%	7
251+	5	12%	2,431	51%	5	99%	80%	4
Total	**41**	**100%**	**4,755**	**100%**	**41**			**30**

Stratum	Employees Sampled Per Mine	Total Sample Employees	Nonresponse Adjusted Mine Weight	Average Employee Weight	Mine *DEFF*	Employee D_w	Employee ρ	Employee D_c	Employee *DEFF*
1–9	4	34	1.25	1.3	1.0	1.00	5%	1.2	1.2
10–25	19	27	1.25	1.3	1.0	1.00	5%	1.9	1.9
26–50	18	104	1.25	2.5	1.0	1.00	5%	1.9	1.9
51–75	19	59	1.25	3.8	1.0	1.00	3%	1.6	1.6
76–100	20	15	1.25	5.0	1.0	1.00	3%	1.6	1.6
101–250	24	169	1.25	9.6	1.0	1.03	1%	1.2	1.3
251+	24	96	1.25	25.1	1.0	1.26	1%	1.2	1.5
Total		**504**			**1.0**	**2.18**	**3%**	**1.1**	**2.4**

Table F-6. Sample Allocation for Surface Nonmetal Mines

Stratum	Number of Mines	Percentage of Total Mines	Number of Employees	Percentage of Total Employees	Sample Mines	Eligibility Rate	Response Rate	Responding Eligible Mines
1–9	347	53%	1,454	8%	92	85%	80%	63
10–25	136	21%	2,094	12%	65	90%	80%	47
26–50	73	11%	2,768	15%	46	90%	80%	33
51–75	45	7%	2,799	16%	34	95%	80%	26
76–100	14	2%	1,191	7%	14	99%	80%	11
101–250	25	4%	3,790	21%	25	99%	80%	20
251+	10	2%	3,785	21%	10	99%	80%	8
Total	**650**	**100%**	**17,881**	**100%**	**286**			**207**

Stratum	Employees Sampled Per Mine	Total Sample Employees	Nonresponse Adjusted Mine Weight	Average Employee Weight	Mine *DEFF*	Employee D_w	Employee ρ	Employee D_c	Employee *DEFF*
1–9	4	262	4.71	4.7	1.0	1.00	5%	1.2	1.2
10–25	15	721	2.62	2.6	1.0	1.00	5%	1.7	1.7
26–50	19	628	1.98	4.0	1.0	1.00	5%	1.9	1.9
51–75	21	536	1.65	5.0	1.0	1.00	3%	1.6	1.6
76–100	21	236	1.25	5.0	1.0	1.00	3%	1.6	1.6
101–250	23	450	1.25	8.3	1.0	1.04	1%	1.2	1.3
251+	24	191	1.25	19.6	1.0	1.15	1%	1.2	1.4
Total		**3023**			**1.2**	**1.65**	**3%**	**1.0**	**1.6**

Table F-7. Sample Allocation for Underground Stone Mines

Stratum	Number of Mines	Percentage of Total Mines	Number of Employees	Percentage of Total Employees	Sample Mines	Eligibility Rate	Response Rate	Responding Eligible Mines
1–9	20	18%	102	3%	20	85%	80%	14
10–25	48	43%	766	22%	35	90%	80%	25
26–50	28	25%	955	27%	23	90%	80%	17
51–75	10	9%	610	17%	10	95%	80%	8
76–100	1	1%	91	3%	1	95%	80%	1
101–250	3	3%	377	11%	3	99%	80%	2
251+	1	1%	637	18%	1	99%	80%	1
Total	**111**	**100%**	**3,538**	**100%**	**93**			**67**

Stratum	Employees Sampled Per Mine	Total Sample Employees	Nonresponse Adjusted Mine Weight	Average Employee Weight	Mine *DEFF*	Employee D_w	Employee ρ	Employee D_c	Employee *DEFF*
1–9	5	69	1.3	1.3	1.0	1.000	5%	1.2	1.2
10–25	16	402	1.7	1.7	1.0	1.000	5%	1.7	1.7
26–50	17	282	1.5	3.0	1.0	1.000	5%	1.8	1.8
51–75	20	155	1.3	3.8	1.0	1.000	3%	1.6	1.6
76–100	23	17	1.3	5.0	1.0	1.000	3%	1.7	1.7
101–250	22	53	1.3	7.1	1.0	1.007	1%	1.2	1.2
251+	25	19	1.3	32.5	1.0	1.000	1%	1.2	1.2
Total		**998**			**1.0**	**2.710**	**3%**	**1.0**	**2.6**

Table F-8. Sample Allocation for Surface Stone Mines

Stratum	Number of Mines	Percentage of Total Mines	Number of Employees	Percentage of Total Employees	Sample Mines	Eligibility Rate	Response Rate	Responding Eligible Mines
1–9	1,698	46%	8,067	11%	116	85%	80%	79
10–25	1,304	35%	20,497	28%	114	90%	80%	82
26–50	402	11%	13,862	19%	95	90%	80%	68
51–75	104	3%	6,356	9%	51	95%	80%	39
76–100	54	1%	4,704	6%	35	95%	80%	27
101–250	124	3%	17,528	24%	62	99%	80%	49
251+	6	0%	1,796	2%	6	99%	80%	5
Total	**3,692**	**100%**	**72,810**	**100%**	**479**			**349**

Stratum	Employees Sampled Per Mine	Total Sample Employees	Nonresponse Adjusted Mine Weight	Average Employee Weight	Mine *DEFF*	Employee D_w	Employee ρ	Employee D_c	Employee *DEFF*
1–9	5	375	18.3	18.3	1.0	1.000	5%	1.2	1.2
10–25	16	1,290	14.3	14.3	1.0	1.000	5%	1.7	1.7
26–50	17	1,179	5.3	10.6	1.0	1.000	5%	1.8	1.8
51–75	20	790	2.5	7.6	1.0	1.000	3%	1.6	1.6
76–100	22	579	1.9	7.7	1.0	1.000	3%	1.6	1.6
101–250	23	1,126	2.5	15.4	1.0	1.046	1%	1.2	1.3
251+	24	114	1.3	15.7	1.0	1.028	1%	1.2	1.3
Total		**5,453**			**1.5**	**1.092**	**3%**	**1.0**	**1.1**

Table F-9. Sample Allocation for Sand and Gravel Mines

Stratum	Number of Mines	Percentage of Total Mines	Number of Employees	Percentage of Total Employees	Sample Mines	Eligibility Rate	Response Rate	Responding Eligible Mines
1–3	2,589	42.6%	5,504	13.3%	119	85%	80%	81
4–6	1,572	25.9%	7,570	18.4%	80	85%	80%	54
7–9	748	12.3%	5,872	14.2%	37	85%	80%	25
10–25	963	15.9%	13,995	33.9%	110	90%	80%	79
26–50	168	2.8%	5,743	13.9%	70	95%	80%	53
51–75	27	0.4%	1,607	3.9%	16	95%	80%	12
76–100	3	0.0%	264	0.6%	3	99%	80%	2
101–250	4	0.1%	683	1.7%	4	99%	80%	3
251+	0	0.0%	0	0.0%	---	---	---	---
Total	**6,074**	**100.0%**	**41,238**	**100%**	**439**			**311**

Stratum	Employees Sampled Per Mine	Total Sample Employees	Nonresponse Adjusted Mine Weight	Average Employee Weight	Mine *DEFF*	Employee D_w	Employee ρ	Employee D_c	Employee *DEFF*
1–3	2	172	27	27	1.00	1.00	5%	1.1	1.06
4–6	5	262	25	25	1.00	1.00	5%	1.2	1.19
7–9	8	198	25	25	1.00	1.00	5%	1.3	1.34
10–25	15	1,151	11	11	1.00	1.00	5%	1.7	1.68
26–50	17	909	3	6	1.00	1.00	5%	1.8	1.80
51–75	20	241	2	6	1.00	1.00	3%	1.6	1.57
76–100	22	52	1	5	1.00	1.00	3%	1.6	1.63
101–250	24	75	1	9	1.00	1.01	1%	1.2	1.24
251+	---	---	---	---	---	---	---	---	---
Total		**3,060**			**1.35**	**1.37**	**5%**	**1.0**	**1.30**

Appendix G. Critical Items from the Questionnaire

National Survey of the Mining Population.

Final List of Critical Items
October 31, 2008

Question Number	Variable Name
M1a	EMP_TRAIN_REF
M1b	EMP_TRAIN_INEXP
M1c	EMP_TRAIN_EXP
M10	LANG_NON_ENG
M11	MATS_NON_ENG
M14	ADD_MATS_NON_ENG
M16aa	PROD_WORKERS SCH_DAYS_PROD
M16ab	SCH_HOURS_PROD
M16ac	ACT_HOURS_PROD
M16ad	CH_SHIFTS_PROD
M16ae	TRAV_HOURS_PROD TRAV_MINUTES_PROD
M16ba	PROD_SUP_WORKERS SCH_DAYS_PROD_SUP
M16bb	SCH_HOURS_PROD_SUP
M16bc	ACT_HOURS_PROD_SUP
M16bd	CH_SHIFTS_PROD_SUP
M16be	TRAV_HOURS_PROD_SUP TRAV_MINUTES_PROD_SUP
M16ca	PREP_WORKERS SCH_DAYS_PREP
M16cb	SCH_HOURS_PREP
M16cc	ACT_HOURS_PREP
M17a	PROD_WORKERS SHIFTS_DAY_PROD

Question Number	Variable Name
M17b	PROD_SUP_WORKERS SHIFTS_DAY_PROD_SUP
M17c	PREP_WORKERS SHIFTS_DAY_PREP
M23a	USE_CONT_DEVELOP
M23b	USE_CONT_CONST
M23c	USE_CONT_DEMO
M23d	USE_CONT_DAMS
M23e	USE_CONT_EXCAV
M23f	USE_CONT_EQUIP
M23g	USE_CONT_EQUIP_SRV
M23h	USE_CONT_MATERIAL
M23i	USE_CONT_DRILL
M23j	USE_CONT_PROD
M23k	USE_CONT_MINERAL
M23l	USE_CONT_OTHER
M24a	NUM_CONT_DEVELOP
M24b	NUM_CONT_CONST
M24c	NUM_CONT_DEMO
M24d	NUM_CONT_DAMS
M24e	NUM_CONT_EXCAV
M24f	NUM_CONT_EQUIP
M24g	NUM_CONT_EQUIP_SRV
M24h	NUM_CONT_MATERIAL
M24i	NUM_CONT_DRILL
M24j	NUM_CONT_PROD
M24k	NUM_CONT_MINERAL
M24l	NUM_CONT_OTHER
Step3	TOTAL_NUMBER

Question Number	Variable Name
E2	JOB_TITLE
E3,	TITLE_EXP_MNTHS TITLE_EXP_YRS
E4, or	THIS_MINE_MNTHS THIS_MINE_YRS
E5	TOTAL_MINE_MNTHS TOTAL_MINE_YRS
E7	WORK_LOCATE
E8	GENDER
E9 or	LATINO
E10	RACE_INDIAN RACE_ASIAN RACE_BLACK RACE_HAWAIIAN RACE_WHITE

Appendix H. Glossary of Mining Terms

Unless otherwise noted, the source of the definitions in this Glossary is the Dictionary of Mining, Mineral, and Related Terms [American Geological Institute 1997].

Active mining area. 1. The area, on and beneath land, related to the extraction, removal, or recovery of coal from its natural deposits. This term excludes coal preparation plants, areas associated with coal preparation plants, and post-mining areas. 2. The area in which active mining takes place relative also to extraction of metal ores, industrial minerals, and other minerals of economic value.

Annual miner refresher training. Training given to all miners at least once a year consisting of 8 hours of instruction reviewing the essentials of new miner training [30 CFR 48].

Cache. The place where provisions, safety or rescue equipment, ammunition, etc., are cached or hidden by trappers, miners, or prospectors, in unsettled regions

Contractor. 1. The person who signs a contract to do certain specified work at a certain rate of payment. In mining, the contractor is an experienced miner or hard-heading miner. He or she employs other people and the work may proceed on a three-shift basis. 2. Mine worker undertaking special tasks on a contractual basis such as shaft sinking, development blasting, etc.

Dedicated telephones. A type of wired communications devise used in mining operations to carry voice transmissions [NIOSH 2009].

Electronic or computerized tagging or tracking systems/devices. Technology designed to identify the location of miners in the event of a mine emergency. Miner tracking systems use wireless communications technology and can be integrated with communication networks [NIOSH 2009].

Escapeway. An opening through which the miners may leave the mine if the ordinary exit is obstructed.

Face. The surface of an unbroken coal bed at the advancing end of the working place.

Filter self-rescuers (FSRs). A type of gas mask for escape from underground mines which provides at least 1 hour of protection against carbon monoxide [30 CFR 75.2].

Flexalert (Mine Radio Systems, Canada). An emergency evacuation system that employs a low frequency electromagnetic field to convey information to miners wearing special cap lamp receivers. It is a one-way Through-the-Earth (TTE) transmission system [Schiffbauer et al n.d.].

Inductive coupled radios. A mining communication system that uses existing mine wires as a carrier for radio signals [30 CFR 49].

Leaky feeder communications system. A two-way radio system that features a base station on the surface that communicates with individual underground radio units, such as walkie-talkie radios. To allow radio frequencies to function underground, it is necessary to replace a standard surface antenna with a cable network. The cable is designed to “leak” signal, which allows radio transmissions to both leak from the cable and also enter the cable [Schiffbauer et al. n.d.].

Lifelines. An emergency escape rope with directional cones designed to help evacuate an underground mine in the event of a fire or explosion leading employees to the slope and shaft rather than getting lost or confused [CAB Products n.d.].

Mill. A mineral treatment plant in which crushing, wet grinding, and further treatment of ore is conducted. A preparation facility within which metal ore is cleaned, concentrated, or otherwise processed before it is shipped to the customer, refiner, smelter, or manufacturer.

Mine page phones. Self-contained battery-powered communication units that provide loudspeaker paging and handset party line conversation over a two-conductor telephone line [MSHA n.d.a].

New miner training. Mandatory training given to miners having no previous mining experience; includes instruction in the statutory rights of miners and their representatives, use of self-rescue devices and respiratory devices where appropriate, hazard recognition, emergency procedures, electrical hazards, first aid, walk-around training, and other health and safety aspects of the tasks to which the person will be assigned [30 CFR 46].

Personal Emergency Device (Mine Site Technologies, Australia). A one-way communication system featuring a belt-wearable device or paging receiver/cap lamp. The system generally consists of a transmitter capable of sending communications that can be received as a text message by miners [MSHA n.d.a].

Preparation plant. Any facility where coal is prepared for market, but by common usage it has come to mean a rather elaborate collection of facilities where coal is separated from its impurities, washed and sized, and loaded for shipment.

Refuge chamber. An airtight, fire-resistant room in a mine used as a refuge in emergencies by miners unable to reach the surface.

Rescue team. A team of workers, from five to eight strong, trained in the use of breathing apparatus and in rescue operations after colliery explosions or mine fires.

Sealing Materials. Emergency supplies designed to rapidly, safely, and efficiently control underground mine fires by sealing off a section of the mine in order to reduce the exchange of oxygen to the fire. Materials should be readily available at the mine, should require minimum time for construction, should minimize air leakage into and out of the fire area, should be capable of withstanding explosion overpressures [Sapko et al. 2003].

Self-contained self-rescuer (SCSR). A respiratory device, usually worn on the belt by miners, used for the purpose of escape during mine fires and explosions. It provides the wearer with a closed-circuit supply of oxygen for a minimum of 10 minutes and up to 1 hour.

Shaft. An excavation of limited area compared with its depth; made for finding or mining ore or coal; raising water, ore, rock, or coal; hoisting and lowering workers and material; or ventilating underground workings.

Stench. A substance with a distinctive, disagreeable odor put in the air current to warn underground workers of fire or other emergency; ethyl mercaptan is commonly used.

Stoppings. Elongated extensible panels extending vertically from the floor to the roof of a passage in a mine. The panels impede the flow of air through the passageway except for a space at a side of the passageway because of irregularity of the side of the passageway. The stopping further has means for impeding the flow of air through the space comprising at least one side extension for the stopping [Kennedy and Kennedy 1984].

Tag boards. "This is a large square or rectangular board equipped with hooks. As miners enter the mine, they hang a brass identification tag on the board. This indicates they are in the mine. As they exit the mine, they remove the tag from the board to indicate they are no longer in the mine." [Vaught 2008].

TeleMag (Transtek, United States). A wireless through-the-earth two-way voice and data communication system. It is a fixed station-to-station system [Schiffbauer et al. n.d.].

Through-the-Earth (TTE) technology. Communication system that is mainly limited to surface-to-underground. TTE requires no cabling between surface to underground and can be portable and worn on the person [Schiffbauer and Brune 2006].

Toolbox talks. Safety and health training discussions, often using materials developed by the Small Mine Office of MSHA or other organizations, that are primarily intended to educate mining operation workers about creating and maintaining safer working conditions [MSHA n.d.b].

TRACKER Tagging System (Mine Site Technologies, Australia). An underground tracking system developed specifically for use in underground mines and tunneling applications. The system tracks active tags carried by personnel or attached to vehicles and other equipment [Mine Site Technologies n.d.].

Trolley phones. A phone system that uses trolleywire-rail power circuit to carry communications. Signals are coupled to the trolley wire and modified trolley voltage operating power for communication circuits [Murphy and Parkinson 1978].

Voice Over Internet Protocol (VOIP) phones. A communications technology that allows you to make voice calls using a broadband Internet connection instead of a regular (or analog) phone line [FCC 2010].

Worksite simulations. Problem-solving exercises developed to support mine health and safety training. The exercises are designed to teach judgment and decision-making skills within two broad domains: (1) how miners respond to mine emergencies (e.g., first aid, self-rescue, and escape) and (2) how miners integrate safety concepts within the context and performance of routine production work [NIOSH 2001].